PCS NITROGEN FERTILIZER, L.P.
GEISMAR, LOUISIANA

SOLID WASTE PERMIT RENEWAL APPLICATION
PHOSPHOGYPSUM FACILITY
GD-005-1822/P-0201

VOLUME I OF V

OCTOBER 2005

PREPARED BY:
PROVIDENCE ENGINEERING AND ENVIRONMENTAL GROUP LLC
6160 PERKINS ROAD, SUITE 100
BATON ROUGE, LOUISIANA 70808
TELEPHONE: (225) 766-7400

TABLE OF CONTENTS

INTRODUCTION

LIST OF TABLES

LIST OF FIGURES

LIST OF FIGURES (Continued)

LIST OF APPENDICES

<u>Appendix</u>

LIST OF APPENDICES (Continued)

INTRODUCTION

INTRODUCTION

The PCS Nitrogen Fertilizer, L.P. (PCS Nitrogen) chemical plant in Geismar, Louisiana operates an on-site facility for the disposal of byproduct phosphogypsum (gypsum), which is generated as a result of the manufacture of phosphoric acid. Phosphoric acid is used, among other things, in manufacturing fertilizer products. For over 30 years, by-product gypsum washed from filters in the phosphoric acid plant has been pumped in slurry form and deposited into settling ponds within the disposal facility. The perimeter levee around the settling ponds is periodically raised by wet-stacking gypsum excavated from sediment deposits within the pond, using the upstream method construction with rim-ditching techniques.

The western gypsum disposal facility includes seven contiguous gypsum stacks (Stacks 1 through 7), process water ponds (Active Clearwell and Auxiliary Active Clearwell), a pond for rainfall run-off from inactive and covered stack areas and other waters managed in the inactive water management system (Inactive Clearwell), and surge ponds. A future gypsum stack expansion site (Stack 8) is located in an adjacent site east of the existing gypsum stacks. Both the current and future gypsum stacking facilities are located within the boundaries of the PCS Nitrogen plant. The plant is located about four miles northwest of Geismar, Louisiana in the northeast quadrant of the intersection of Louisiana Highways 30 and 3115. The stacking facility is bounded by Highway 74 on the north, Highway 30 on the south, Highway 3115 on the east, and a gas pipeline right-of-way on the west. Major drainage is provided by the New River located east of the facility, and by Bayou Braud located one half-mile northwest of the facility. The Mississippi River is located south of the facility adjacent to the plant area of the complex.

The stacking facility area (existing and expansion area) consists of approximately 416 acres for the disposal of approximately 21,000 tons per week of gypsum and related wastes (maximum 1.1 million tons/year). These materials include contaminated filter cloths, rubber lining material, sludge, piping, scale, fire brick, sandblasting waste, waste sulfur, ditch clean-out material, filter aid, cooling tower sludge, contaminated wooden pallets, and plastic sheeting. A permit modification request dated January 25, 1990 and additional information related to the modification dated September 26, 1990 and December 6, 1990 was approved by the LDEQ on January 2, 1991. The modification involved a change in the composition of the waste stream entering the permitted gypsum stacking area. The modification contained information concerning the deposition of contaminated filter cloth, sandblasting waste, waste sulfur, ditch cleanout sludge, filter aid, and cooling tower sludge deposited in the gypsum piles. The LDEQ recommended that the waste streams be placed in a designated area of the gypsum stacks. The waste streams that are deposited in a designated area of the gypsum stacks are permitted waste streams and are consistent with the January 2, 1991 approval. The materials are segregated in a disposal pit on top of stack #7.

The gypsum that is deposited in the stacking facility is produced in the phosphoric acid manufacturing plant located approximately two miles south of the stacking facility. Gypsum, which is chemically known as calcium sulfate dihydrate, is a by-product of the production of phosphoric acid. Approximately 4.8 tons of gypsum (dry basis) is generated for every ton of phosphoric acid (P_2O_5) produced. Phosphoric acid is manufactured by reacting phosphate rock and sulfuric acid to produce a slurry of calcium sulfate hemihydrate ("hemi") and phosphoric acid, which is separated by filtration. After separation from the phosphoric acid, the hemi is hydrated to gypsum in a transformation tank in the presence of process water to which sulfuric acid is added to promote the hydration. Phosphate rock is principally calcium phosphate and calcium fluoride (almost 4% expressed as F) with iron and aluminum in the low percent ranges and other metals in the parts-per-million range. Phosphate rock also contains a small percentage of sand and some clay. All of these non-phosphate impurities in the rock are distributed among the product acid, the process water, and the solid gypsum.

Gypsum is transported in a slurry by pipeline to the gypsum stacking area. The slurry is discharged onto the active stacking area, and the liquid fraction decants and flows by gravity to the Active Clearwell. The slurry is approximately 30% gypsum and 70% process water. From the Active Clearwell, the transport water is returned by pipeline to the phosphoric acid plant for reuse.

The facility is designed to store gypsum in large stacks. Decisions concerning stacking locations, areas, and rate-of-rise have been made based on the recommendations of geotechnical consultants. The gypsum slurry is deposited in a prepared receiving area where there are small dikes constructed of gypsum to direct the discharged gypsum slurry to the correct channels so that the gypsum settles out and the water decants into the Active Clearwell. As the stack height increases, track hoes are utilized to construct additional channels within the stacking area, and the excavated gypsum is used to increase the height of the levees.

PART I

PERMIT APPLICATION FORM

COMPLIANCE INFORMATION

ATTACHMENT 2

CERTIFICATE OF REGISTRATION

UNITED STATES OF AMERICA

State of Louisiana

Fox McKeithen

SECRETARY OF STATE

As Secretary of State, of the State of Louisiana, I do hereby Certify that

PCS NITROGEN FERTILIZER, L.P.

A DELAWARE Partnership whose principal place of business is MEMPHIS, TENNESSEE,

Filed partnership documents and registered to do business in this State on March 20, 1992.

I further certify that no certificate of termination has been issued.

In testimony whereof, I have hereunto set my hand and caused the Seal of my Office to be affixed at the City of Baton Rouge on,

June 27, 2000

Fox McKeithen

BBE 34408413L

Secretary of State

STATE OF LOUISIANA · UNION JUSTICE CONFIDENCE · SECRETARY OF STATE

CERTIFICATE SS 102 S (R-3/88)

PART II

SUPPLEMENTARY INFORMATION

S2-1A

LOUISIANA ADMINISTRATIVE CODE (LAC)
TITLE 33 - ENVIRONMENTAL QUALITY
PART VII - SOLID WASTE

§521. Part II: Supplementary Information, All Processing and Disposal Facilities

The following information is required in the permit application for solid waste processing and disposal facilities. All responses and exhibits must be identified in the following sequence to facilitate the evaluation. Additionally, all applicable sections of LAC 33:VII.Chapter 7 must be addressed and incorporated into the application responses. If a section does not apply, the applicant must state that it does not apply and explain why.

A. Location Characteristics. Standards pertaining to location characteristics are contained in LAC 33:VII.709.A (Type I and II facilities), LAC 33:VII.717.A (Type I-A and II-A facilities, and LAC 33:719.A (Type III facilities).

1. The following information on location characteristics is required for all facilities:

a. Area Master Plans - a location map showing the facility, road network, major drainage systems, drainage-flow patterns, location of closest population center(s), location of the public-use airport(s) used by turbojet aircraft or piston-type aircraft, proof of notification of affected airport and Federal Aviation Administration as provided in LAC 33:VII.709.A.2, location of the 100-year flood plain, and other pertinent information. The scale of the maps and drawings must be legible, and engineering drawings are required.

The Site Location Map (**Figure 1**) shows the PCS Nitrogen Fertilizer, L.P. Geismar Complex (PCS Nitrogen) along with the major drainage systems, highways, and buildings within several miles of the complex. The gypsum facility is located in the northeast quadrant of the intersection of Louisiana Highways 30 and 3115. The gypsum facility is bounded by Highway 74 on the north, Highway 30 on the south, Highway 3115 and a gas pipeline right-of-way on the west.

Access to PCS Nitrogen is by all-weather roads that meet the demands of the facility and are designed to avoid, to the extent practicable, congestion, sharp turns, obstructions, or other hazards conducive to accidents. Furthermore, the roadways are adequate to withstand the weight of transportation vehicles.

The facility has two units - the west unit and the east unit. The east unit lies to the east of the Entergy right-of-way on the eastern edge of the west unit. An outer berm is constructed around the cleared east unit; however, the unit is not yet an active part of the gypsum stacking operations.

The road network to the facility is shown on **Figure 2**. The gypsum facility is accessible from both Louisiana Highways 30 and 3115. Currently, PCS Nitrogen does not receive any off-site generated material at the gypsum facility.

The facility is not located within 10,000 feet of any public-use airport runway or within 5,000 feet of any public-use airport runway end used by only piston-type aircraft.

Major drainage is provided by the New River located east of the facility and by Bayou Braud located one half-mile northwest of the facility. The Mississippi River is located south of the facility adjacent to the plant area of the complex.

The facility lies within the 100-year flood plain. The location of the 100-year flood plain is shown on **Figure 3.** The drainage around the existing west unit of the gypsum facility is shown in **Appendix B** (**Figure 1**). A ditch that runs along the Entergy right-of-way provides drainage between the east unit and the west unit.

The nearest population center is St. Gabriel, Louisiana located approximately 3 miles to the west of the facility on Louisiana Highway 30, as shown on **Figure 1**.

b. A letter from the appropriate agency or agencies regarding those facilities receiving waste generated off-site, stating that the facility will not have a significant adverse impact on the traffic flow of area roadways and that the construction, maintenance, or proposed upgrading of such roads is adequate to withstand the weight of the vehicles.

The gypsum facility is used only for the disposal of on-site generated gypsum and related wastes.

c. **Existing Land Use - a description of the total existing land use within three miles of the facility (by approximate percentage) including, but not limited to:**

   i. **residential;**

   ii. **health-care facilities and schools;**

   iii. **agricultural;**

   iv. **industrial and manufacturing;**

   v. **other commercial;**

   vi. **recreational; and**

   vii. **undeveloped.**

   The existing land use (in approximate percentages) within 3 miles of the facility is summarized as follows:

   i. residential---8%
   ii. health-care facilities and schools---------------1%
   iii. agricultural--40%
   iv. industrial and manufacturing-------------------30%
   v. other commercial----------------------------------10%
   vi. recreational---4%
   vii. undeveloped--7%

d. **Aerial Photograph—a current aerial photograph, representative of the current land use, of a one-mile radius surrounding the facility. The aerial photograph shall be of sufficient scale to depict all pertinent features. (The administrative authority may waive the requirement for an aerial photograph for Type III facilities.)**

   An aerial photograph of the facility is shown on **Figure 4**.

e. **Environmental Characteristics—the following information on environmental characteristics:**

   i. **a list of all known historic sites, recreation areas, archaeological sites, designated wildlife-management areas, swamps and marshes, wetlands, habitats for endangered species, and other sensitive ecological areas within 1000 feet**

of the facility perimeter or as otherwise appropriate;

There is a wetlands area north of the east unit and east of the northeast part of the west unit of the facility, which is shown in (**Figure 7**). There are no known historic sites, recreation areas, designated wildlife-management areas, swamps or marshes, or habitats for endangered species within 1,000 feet of the facility perimeter. There is a known archaeological site located within 1,000 feet of the facility. However, according to documentation from the Louisiana Department of Culture, Recreation, and Tourism, the gypsum stacking facility, because of the nature of the operations, will not affect the archeological site. The referenced documentation indicates "no objection" to the gypsum stacking facility. (See **Appendix C**.)

ii. **documentation from the appropriate state and federal agencies substantiating the historic sites, recreation areas, archaeological sites, designated wildlife-management areas, wetlands, habitats for endangered species, and other sensitive ecological areas within l,000 feet of the facility; and**

In 1990, the U.S. Army Corps of Engineers (USACE) determined that the west unit gypsum facility does not lie within a wetland area. However, wetland areas do surround the facility within 1,000 feet of the north border of the east unit and within 1,000 feet of the northeast corner of Stack 6 in the west unit of the facility. Since the designation, PCS Nitrogen constructed a levee around the east unit of the facility in preparation for future use.

A letter from the USACE that extends the Corps' jurisdictional delineation of the wetlands area north of the east unit of the facility is included in **Appendix C**. The delineation (See **Appendix C**, **Figure 1**) shows that the facility does not lie within a wetland area. The delineation also shows wetlands areas within 1,000 feet of the north boundary of the east unit of the facility and within 1,000 feet of the northeast corner of Stack 6 in the west unit.

Also included in **Appendix C** is a letter of certification from the Louisiana Department of Wildlife and Fisheries.

iii. a description of the measures planned to protect the areas listed from the adverse impact of operation at the facility;

The northeast corner of Stack 6 in the west unit of the gypsum facility lies within 1,000 feet of a wetland area to its east. The west unit is designed with levees as high as, or several feet higher than, the flood plain and several feet higher than adjacent land so there is no run-off from or run-on to the gypsum facility. The facility and its levees are inspected at least twice daily.

The north boundary of the east unit of the gypsum facility lies within 1,000 feet of a wetland area. The east unit is surrounded by a levee that is adequate to protect the area.

Based on information from the Louisiana Department of Culture, Recreation and Tourism, the nearby known archaeological site will not be impacted by the gypsum facility. Furthermore, the referenced documentation indicates no objection by the Department to the gypsum stacking facility (see **Appendix C**).

f. A wetlands demonstration, if applicable, as provided in LAC 33:VII.709.A.4.

Based on a determination by the USACE, the footprint of the gypsum facility (east and west units) addressed by this permit renewal application does not lie within a wetlands area.

g. Demographic Information—the estimated population density within a three-mile radius of the facility boundary, based on the latest census figures.

The estimated population density within a three-mile radius of the gypsum facility based on the latest census data is 1,400.

2. **The following information regarding wells, faults and utilities is required for Type I and II facilities:**

   a. **Wells. Map showing the locations of all known or recorded shot holes and seismic lines, private water wells, oil and/or gas wells, operating or abandoned, within the facility and within 2,000 feet of the facility perimeter and the locations of all public water systems, industrial water wells, and irrigation wells within one mile of the facility. A plan shall be provided to prevent adverse effects on the environment from the wells and shot holes located on the facility.**

   A map showing the locations of all recorded wells, including water wells within one mile of the facility is provided in **Figure 5**.

   There are no known shot holes, seismic lines, or private water wells on the property or within 2,000 feet of the gypsum facility. An abandoned dry oil well is located just to the north of the facility at Section 20 Township 95 Range 2 East. A copy of the Plug and Abandon Record for this well is located in **Appendix D**. Additionally, there are no public water systems within one mile of the facility.

   b. **Faults**

      i. ***scaled map showing the locations of all recorded faults within the facility and within one mile of the perimeter of the facility; and***

      An Aquifer Recharge Map is included as **Figure 6**. Based on this map, there are no recorded faults within the facility, or within one mile of the perimeter of the facility.

      ii. **demonstration, if applicable, of alternative fault setback distance as provided in LAC 33:VII.709.A.5.**

      Not applicable. The facility is not located within 200 feet of a known fault.

   c. **Utilities. Scale map showing the location of all pipelines, power lines, and right-of-ways within the site.**

   Pipelines, power lines, and right-of-ways are shown on **Figure 2**.

B. Facility Characteristics. Standards concerning facility characteristics are contained in LAC 33:VII.709.B (Type I and II facilities), LAC 33.VII.717.B (Type I-A and II-A facilities), and LAC 33:VII.719.B (Type III facilities). A facility plan, including drawings and a narrative, describing the information required below must be provided.

S2-1-B

1. The following information is required for all facilities:

a. elements of the process or disposal system employed, including, as applicable, property lines, original contours (shown at not greater than five-foot intervals), buildings, units of the facility, drainage, ditches and roads;

A Facility Map is included as **Figure 7**.

The facility has two units, the west unit and the east unit. The west unit consists of the gypsum stacking area that is currently in use and that has been in use since the 1960's. It was initially constructed utilizing individual stacking areas called stacks that were identified by number in order of their construction. Stack 1 is located in the southwest part of the west unit, and counter-clockwise are Stacks 2, 3, 4, 5, 6, 7A, and 7B of the west unit. The areas formerly identified as stacks 3 and 7 have been converted into on common stack and identified as stack 3/7. The east unit consists of Stack 8. PCS Nitrogen has implemented a new gypsum-stacking plan for the west unit. As a result, PCS Nitrogen now manages the west unit stacks as one common stack. This has been accomplished by, among other things, depositing gypsum in the areas between the individual stacks. The new stacking plan has been implemented in phases.

The features and structures making up the gypsum facility include gypsum stacking areas, clearwells (working impoundments), evaporation ponds, roads, ditches, drainage pipes, pipelines for gypsum slurry and return water, pumps, and construction equipment such as track hoes, bulldozers, front end loaders, *etc*. Power and utilities are supplied to an on-site trailer used by the facility staff and contract personnel. The site also has a fuel tank for fueling equipment.

<u>**Gypsum Stacking Area**</u>

The principal feature of the gypsum facility is the gypsum stacking areas of the west unit [Stacks 1, 2, 3, 4- 6, and 3/7] and the east unit (Stack 8). The west unit consists of approximately 291 acres and the east unit consists of approximately 125 acres. The east unit lies to the east of the Entergy right-of-way on the eastern edge of the west unit.

Only a portion of the entire stacking area is in service at any given time. The area where gypsum stacking currently is taking place is called the *active area.*

Phases 1 through 8 of the gypsum stacking plan (see **Appendix E**) have been completed. The phases of the current gypsum stacking plan are identified in **Appendix B** (**Figure 1** and **Figure 3 – Figure 8**). In Phase 9, the areas formerly identified as Stacks 3 and 7 were converted into one common stack and identified as Stack 3/7 with a final elevation of 65 feet. In Phase 10, the Phase 9 area (Stack 3/7) will be increased in elevation to 220 feet. PCS Nitrogen is currently stacking in Phase 10. PCS Nitrogen plans to stack gypsum in Phase 10 until approximately 2007.

In Transition Phase 10-11, construction activities will include preparation for, and the actual westward expansion of, gypsum disposal in the areas currently identified as the Active Clearwell and the Auxiliary Active Clearwell. Construction activities will be completed in approximately 2006-2007. As a result of the westward expansion, the Inactive Clearwell will become the Active Clearwell and the Inactive Surge Area (known as the "Triangle Area") will become the Inactive Clearwell. The disposal of gypsum in the transition phase will take place until approximately 2008.

In Phase11, Stack 2/7 will be increased in elevation to a final elevation of 220 feet. PCS Nitrogen will begin stacking in Phase 11 in approximately 2008 and plans to continue stacking gypsum in Phase 11 until approximately 2015.

In Phase 12, PCS Nitrogen will stack in the east unit (Stack 8). Phase 12 will have a final elevation of 80 feet.

The west unit will remain in service for gypsum disposal until approximately 2015. The east unit of the facility is not currently part of the facility's operation and will not be part of the operation until approximately 2015. Construction of the east unit will not commence until approximately 2014.

- **Conversion of the Triangle Area into the Inctive Clearwell**

    - Objective – function as a storm water runoff collection clearwell and serve as the future replacement of the current inactive clearwell that is targeted to be converted to a new high density polyethylene (HDPE) -lined active clearwell during the planned Phase 10 -11 transition.

    - Location – Northwest area of the phosphogypsum solid waste facility between plant coordinates N 12000 and N 12800 and between coordinates E 800 and E 2000.

    - Influent Waters – Direct storm water rainfall/slope runoff from the slope collector ditch system/pumped rainfall and slope runoff from the perimeter lined ditch system.

    - Effluent Water – Pumped through HDPE pipe lines to the inactive 301 discharge system.

    - See **Appendix B** (Inactive Clearwell Drawings).

- ***Conversion of the Current Inactive Clearwell into the Active Clearwell***

    - Objective – Function as a converted active water (process water) HDPE-lined clearwell during the planned Phase 10 – 11 transition.

    - Design Capacity – 100 mm gal.

    - Location – West area of the phosphogypsum solid waste facility between coordinates N 11400 and N 12000, and between plant coordinates E 300 and E 1600.

    - Influent Waters – Decant and leachate waters from the active stacking areas.

    - Effluent Water – Pumped as return process water for the phosphoric acid plant production process.

    - See **Appendix B** (Phase Drawings).

<u>Clearwells (Working Impoundments)</u>
The Inactive Clearwell is used to accumulate excess rainfall that falls on the inactive portions of the facility along with other waters managed in the inactive water management system. Water from the Inactive Clearwell is either discharged to the Mississippi River in accordance with the terms and conditions of the (Louisiana Pollutant Discharge Elimination Discharge Elimination System (LPDES) Permit or is transferred to the Active Clearwell for use in the phosphoric acid production process. The Active Clearwell receives run-off water from the active stacking area, and leachate from the active gypsum stacking facility and, to the extent feasible, from the inactive portions of the stacking facility. The Auxiliary Active Clearwell acts as a surge control area for the active stacking area. The waters from the Active Clearwell and the Auxiliary Active Clearwell are returned to the phosphoric acid process. The Inactive Surge Area (the Triangle Area) serves as a surge control area for the inactive portions of the unit.

As the gypsum stacking plan progresses, the location and function (active or inactive) of the clearwells will change in accordance with PCS Nitrogen's Water Management Plan. The Water Management Plan is outlined in the Operational Plan in **Appendix F**.

<u>Storm Water Surge Ponds</u>
The Storm Water Surge Ponds are located along the southeastern edge of the facility and collect run-off from capped and grassed areas of the facility.

<u>Evaporation Ponds</u>
Evaporation Ponds are temporary shallow ponds that may be used to reduce by evaporation the amount of water that must be managed in the facility. If used, the evaporation ponds will be constructed in inactive stacking areas of the facility and the location of the evaporation ponds will change as the west unit matures.

<u>Cells 2A, 2B, 2C, and 2D</u>
These HDPE lined cells are temporary units associated with Phases 9 and 10 and will be used as holding ponds and/or evaporation ponds until gypsum is placed in these areas of the stacking facility.

<u>Roads</u>
The roads within the facility are shown in **Appendix B (Figure 1)**.

Ditches
Ditches are used to manage water in the facility. Most of the ditches are perimeter ditches used to collect and transport rainfall run-off from the gypsum stacking areas to the appropriate clearwells.

Interceptor Ditches
Surface run-off from the facility is collected in interceptor ditches and pumped to the Inactive Clearwell.

Toe Drains (Inactive Clearwell)
Drainage pipes are located in a toe drain collection system surrounding the Inactive Clearwell. This water is pumped back to the Inactive Clearwell.

Toe Drains (Interceptor Ditches)
Toe drains are constructed in association with the perimeter ditches and are located along the perimeter of the gypsum stacking facility. Leachate from this toe drain system is pumped to the Active Clearwell.

Pipelines
The gypsum is transported in a slurry by pipeline (the gypsum line) to the gypsum stacking area. The slurry is discharged onto the active stacking area. The liquid fraction decants and flows by gravity to the Active Clearwell. From the Active Clearwell, the transport water is returned by pipeline (the return water line) to the phosphoric acid plant for reuse. The pipelines are moveable, and there is usually one spare (gypsum) line.

Pumps
Pumps are used to deliver water from ditches and toe drain systems to clearwells, and from one clearwell to another. The pumps are also used to move water from the clearwells to either the permitted outfall, or to the phosphoric acid process area.

Equipment
Track hoes and other earth-moving equipment are used to maintain levees, to contour gypsum stacking areas, and to manage soil (clay capping) for the purpose of growing grass on selected surfaces of the inactive and active stacking areas.

b. the perimeter barrier and other control measures;

The facility is fenced on the north, west, and south perimeter. The east boundary is not accessible by automobile and cannot be reached by foot except by willful entry. Warning signs are posted along the fenced area. Gates are either locked or manned at all times. In addition, plant security patrols are conducted 24 hours a day, and plant operating personnel typically inspect the facility at least twice daily.

c. **a buffer zone;**

The buffer zone extends to at least 200 feet from the gypsum facility perimeter, except at the northeast corner of stack 7A, as shown on **Figure 8**. A letter of no objection to this decrease in the buffer zone from the Louisiana Department of Transportation and Development (LDOTD) is shown in **Appendix C**.

d. **fire-protection measures;**

Because of the nature of the facility and the gypsum, fire protection is not urgently needed. However, should an emergency occur, fire protection is provided by an on-site fire brigade, which is jointly supported by Honeywell, Williams, and PCS Nitrogen. The fire department is equipped with a fire truck, foam trailer and all associated equipment. Honeywell's fire truck is located in a central maintenance building located just north of the production area and south of the gypsum facility.

A letter from PCS Nitrogen certifying that the facility can respond to and manage fire emergencies is included in **Appendix C**.

The nearest fire station for response is the East Iberville Volunteer Fire Department.

e. **landscaping and other beautification efforts;**

A grass cover is installed on certain side slopes of the gypsum stacks. The purpose of the cover is to reduce contamination of rainfall run-off, to reduce infiltration, and to prepare the facility for ultimate closure. Ultimately, all current and former gypsum stacking areas will have a grass cover, which will give the stacks an aesthetically pleasing appearance.

f. **devices or methods to determine, record, and monitor incoming waste;**

A record of the waste in the gypsum facility is maintained in the environmental central files for at least two years with off-site retention at least five years. Since it is impractical to accurately meter the gypsum, the quantity recorded is calculated on a dry basis using a standard factor, which is derived from the composition of the feed rock and reactions taking place in the process. It is not practical to measure the quantities of liquids associated with the gypsum received at the facility, as these liquids are recovered and returned to the process to the greatest extent possible. Other non-hazardous solid wastes resulting from the on-site production of phosphoric acid and phosphate fertilizers that are manually deposited in the gypsum facility are weighed and manifested. Manifests and weigh tickets are maintained for three years. A permanent record of the total quantity of wastes, except for the liquid in the gypsum slurry, is maintained in the environmental central files for at least two years with off-site retention at least five years.

Clay and soil from borrow pits and on-site waste from the clean out of ditches and containment areas that contain plant nutrients are used on an as-needed basis to install, promote, and maintain the grass cover.

g. NPDES discharge points (existing and proposed); and

In accordance with the LPDES Permit, PCS Nitrogen is authorized to discharge from Outfall 001 (including internal Outfalls 101, 201, 301, and 401) and Outfall 005. The former is for treated process water, process area storm water, utility wastewater, once through barometric cooling water, and maintenance wastewaters, which discharges to the Mississippi River. The latter is for non-process area storm water that discharges to parish drainage, thence to Bayou Braud.

The coordinates for Outfall 001 are:

Latitude – 30° 12' 58"
Longitude – 91° 03' 11"

The coordinates for Outfall 005 are:

Latitude – 30° 13' 36"
Longitude – 91° 03' 23"

Storm water from the inactive gypsum stacking areas along with other waters managed in the inactive water management system are discharged via internal Outfall 301, thence to Outfall 001. The upstream outfalls for process water from PCS Nitrogen are internal Outfalls 101 and 201. All upstream outfalls commingle and are discharged through Outfall 001.

PCS Nitrogen will continue to manage all discharges from the facility in accordance with all applicable discharge permits.

A copy of the LPDES Discharge Permit is located in **Appendix G**.

h. ***other features, as appropriate.***
N/A.

2. The following information is required for Type I and II facilities:

a. areas for isolating nonputrescible waste or incinerator ash, and borrow areas; and

N/A.

b. location of leachate collection/treatment/removal system.

There are three kinds of leachate collection activities: (1) collection of leachate in toe drains around the Inactive Clearwell; (2) collection of leachate (from the lower sides and bases of the gypsum stack) in the perimeter ditches, internal ditches, and clearwells; and (3) under drains from areas lined with HDPE.

The existing drain pipes, ditch system, and toe drains associated with the leachate collection system are shown in **Appendix B** (**Figure 1**). Anticipated future locations and upgrades are shown in **Appendix B** (**Figure 3 - Figure 8**). The ditches currently surround the west unit, and will surround the east unit (Stack 8) once the east unit is constructed.

C. **Facility Surface Hydrology. Standards governing facility surface hydrology are contained in LAC 33:VII.711.A (Type I and II landfills), LAC 33:VII.713.A (Type I and II surface impoundments), LAC 33:VII.715.A (Type I and II landfarms), LAC 33:VII.717.C. (Type I-A and II-A facilities), and LAC 33:VII.719.C (Type III facilities).**

1. **The following information regarding surface hydrology is required for all facilities:**

a. **a description of the method to be used to prevent surface drainage through the operating areas of the facility;**

S2 1 C

The main operating area of the gypsum facility is the area where gypsum slurry is deposited. This area, the active stacking area, is channeled and diked to direct decanted gypsum transport water and rainfall towards the Active Clearwell. Because of the elevation of these areas, surface drainage will not flow through the main stacking areas of the site, but away from them.

b. **a description of the facility run-off/run-on collection system;**

Surface run-off from the gypsum facility is collected in interceptor ditches and pumped to the Inactive Clearwell. Surface drainage surrounding the facility cannot run onto the facility because the elevation of the perimeter levees have been set several feet higher than the adjacent land surface, and as high as or several feet higher than the 100-year flood plain of 15 feet mean sea level (MSL).

The top elevation of the perimeter levees associated with the west unit is approximately 18.2 feet MSL and is shown in **Appendix B (Figure 1)**.

Phase 12 (Stack 8) in the east unit is not yet operational. Preliminary work on the east unit has consisted of erecting a small berm approximately five feet above grade around the perimeter of the proposed stacking area. The proposed elevation of the interceptor dikes for Stack 8 is approximately 20.0 feet MSL and is shown in **Appendix B (Figure 7)**.

In summary, the 100-year floodplain is 15 feet MSL and the top elevation of the perimeter levees associated with the west unit is approximately 18.2 feet MSL. The proposed elevation of the interceptor dikes for Stack 8 is approximately 20.0 feet MSL.

c. **the maximum rainfall from a 24-hour/25-year storm event;**

The maximum 24-hour/25-year rainfall recorded in the area, as reported by the National Weather Bureau, was 9.9 inches. The facility can accommodate the 24-hour/25-year rainfall event.

d. **the location of aquifer recharge areas in the site or within l,000 feet of the site perimeter, along with a description of the measures planned to protect those areas from the adverse impact of operations at the facility; and**

There is no known aquifer recharge area within the facility or within 1,000 feet of the gypsum facility perimeter. There is a wetlands area north of the east unit and east of the northeast corner of the west unit, within 1,000 feet of the facility in both cases, but no specific aquifer recharge area within that wetlands area has been identified. Perimeter levees for the west unit are sufficient to prevent run-off from the gypsum facility to surrounding areas, and perimeter levees for the east unit will also be sufficient to prevent any impact to adjoining areas from run-off.

e. **if the facility is located in a flood plain, a plan to ensure that the facility does not restrict the flow of the 100-year base flood or significantly reduce the temporary water-storage capacity of the flood plain, and documentation indicating that the design of the facility is such that the flooding does not affect the integrity of the facility or result in the washout of solid waste.**

The facility lies within the 100-year flood plain, and, in effect, is located on the southwestern corner of that floodplain. The southern boundary of the facility lies on Louisiana Highway 30, and the western boundary lies on Louisiana Highway 3115, which restrict the flow independently of the facility. In general, the natural flow is to the north away from the Mississippi River so that the presence of the facility, which is located on the edge of the flood plain, has little effect on the flow of floodwaters within the flood plain and floodwaters have little effect on the facility.

The minimum elevation of the perimeter levees of the west unit is 20.0 feet MSL and the minimum elevation of the perimeter levees of the east unit is 18.2 feet MSL. The perimeter levees are over 3.0 feet above the 100-year flood elevation of 15 feet MSL. Therefore, the perimeter levees provide adequate freeboard (protection) against the 100-year flood elevation.

The perimeter levee system of the facility is designed and constructed above the 100-year flood elevation to protect the facility from flooding and related effects. The facility lies within a contiguous floodplain that is calculated to be over 14,250 acres in total area. The removal of the 416 acres used for the disposal facility would reduce the available floodplain acreage by less than 3%. Construction and operation of the east and west units of the facility will not restrict the flow of the 100-year flood or significantly reduce the temporary water-storage capacity of the flood plain.

D. Facility Geology. Standards governing facility geology are contained in LAC 33:VII.709.C (Type I and II facilities), LAC 33:VII.717.D (Type I-A and II-A facilities), and LAC 33:VII.719.D (Type III facilities).

1. The following information regarding geology is required for Type I and Type II facilities:

a. isometric profile and cross-sections of soils, by type, thickness, and permeability;

Several geotechnical field exploration programs were conducted at the site during the past 25 years. Approximately 290 soil borings (see **Figure 9**) were installed to a maximum depth of 105 feet below ground surface (bgs). Approximately 50 percent of these borings were advanced to depths greater than 50 feet bgs. Approximately 240 of the borings were performed either in virgin ground areas prior to gypsum stacking or near the toe of the slope of the existing gypsum stacks. The remaining borings were performed through existing gypsum ranging in thickness from 10 to 80 feet.

S2 I D

Based on the data from these soil borings, the soil stratigraphy underlying the stacks is shown on the cross sections included in **Appendix I**. An Isometric Soil Profile is depicted in **Appendix J.**

Based on these figures, a description of the soil strata found across the site is summarized below.

Depth (feet bgs)	Stratum Description
0 to 10	Medium to stiff strength clay becoming softer with depth. Such crust–the product of surface desiccation–contains pockets and sublayers of clayey silt.
10 to 20	Firm to dense clayey silt containing pockets of soft clay.
20 to 55	A heterogeneous mixture of soft to medium strength silty clay (60%) and loose to firm silt/clayey silt (40%).
Below 55	Dense to very dense fine sand.

The clays are typical of alluvial "backswamp" deposits of the Mississippi River flood plain deposited during the time between annual river floods. The colloidal size clay particles settled from stilled water, trapped by low river stage, outboard of "natural" levees. During actual flooding, the larger particulate silt and sand strata and pockets (down to approximately 55 feet bgs) were deposited over the previously placed clay. Such granular material also constituted the natural levees adjacent to the river channel itself. The dense sand below 55 feet bgs is probably a "point bar" type sedimentary deposit formed directly in the river's channel. As the channel shifted away (*i.e.*, meandered) the abandoned point bar was covered by the overlying natural levee/backswamp deposits.

In summary, the soil strata encountered to a depth of 55 feet bgs at the site are fine-grained soils of low permeability. Results of laboratory permeability tests for these soils indicate the following (as detailed in the 1999 Ardaman & Associates Report included in **Appendix K**): silt and sandy silt (ML) samples – permeability (geometric mean value) of 5×10^{-6} centimeters per second (cm/sec); lean clay (CL) samples – permeability (geometric mean value) of 8×10^{-8} cm/sec; and highly plastic clay (CH) samples – permeability (geometric mean value) of 1×10^{-8} cm/sec.

These strata of natural soils having low permeabilities should provide a barrier to prevent any penetration of surface spills into the dense fine sand substratum. The impermeability of the near surface subsoils was enhanced during site preparation by removal of all surface vegetation, backfilling of stump holes with clay, and tracking of the entire surface of the disposal areas with rubber-tired rollers to provide a semi-compacted surface free of holes and fissures.

b. logs of all known soil borings taken on the facility and a description of the methods used to seal abandoned soil borings;

Soil boring logs are included as **Appendix L**. Note that boring logs for P-19 through P-23 could not be found, and only the well registration forms giving brief summaries of the lithology were available. These boring logs in **Appendix L** include soil borings completed by Law Engineering and Testing Company (LETC), Louis Capozzoli & Associates, Inc. (Capozzoli), Eustis Engineering Company, Inc. (Eustis), and Ardaman & Associates, Inc. (Ardaman). A summary of the investigations is shown on **Table 1**. The individual reports for these investigations are included as **Appendix M**. The locations of the soil borings are depicted on **Figure 9**.

Geotechnical evaluations related to the continued raising of Stacks 1 and 2 were performed by LETC in 1973, 1977, and 1979. These studies included test borings located atop the existing stack, and on the perimeter earthen dike and field vane strength tests in the foundation soils beneath the stack. From 1980 through 1987, several test borings were performed, and Capozzoli undertook periodic performance monitoring for Stacks 1 through 6. From 1987 until 1988, Eustis undertook geotechnical field exploration programs related to design and construction of Stack 7 and Stack 8, stability evaluations for the existing stacks, and performance monitoring of the stacks. In 1998, Ardaman conducted a limited field exploration program (not inclusive of the area for Phase 12 (Stack No. 8) to: (i) supplement results of field explorations performed at the site over the past 25 years by others in connection with prior geotechnical design evaluations and performance monitoring programs; and, (ii) recommend a final design for the area encompassing Stacks 1 through 7.

The soil boring logs (**Appendix L**) indicate that the soil was continuously sampled using thin-wall and/or split-spoon devices to at least 30 feet below the base of the stacks (ground surface). The maximum depth of exploration to characterize the shallow geology was 105 feet bgs at borings 7 and 8. Therefore, the requirements of LAC 33:VII.709.C.1.c.ii and iii have been satisfied.

Except directly in Stack 1 and 2 (initiated in 1969), the former Inactive Clearwell and the former Active Clearwell, the maximum spacing between borings is 450 feet or less, in general conformance with the requirements of LAC 33:VII.709.C.1.c.i (see **Appendix L**). It is anticipated that the 290 existing soil borings (many of which were installed adjacent to the perimeter of these areas) are sufficient for characterizing the subsurface shallow geology. Also, new borings/wells are proposed along the perimeter of the gypsum stack in this area.

As indicated on the boring logs, the boreholes were either converted to piezometers/observation/monitor wells or grouted to the surface with a cement-bentonite mix. The procedures used for plugging and abandoning soil borings or converting to piezometers/wells generally conform with

"Water Well Rules, Regulations, and Standards, State of Louisiana" as adopted by the LDOTD, Water Resources Section. For borings completed prior to 1986, the standard practice to abandon boreholes was to backfill with excess soil cuttings from drilling activities. Subsequently, boreholes were abandoned by filling (pumping) with a cement-bentonite grout mixture.

c. **results of tests for classifying soils (moisture contents, Atterberg limits, gradation, etc.), measuring soil strength, and determining the coefficients of permeability, and other applicable geotechnical tests;**

Borings, geotechnical field tests, and laboratory tests were conducted according to the applicable standards of the American Society for Testing and Materials (ASTM) or the United States Environmental Protection Agency (USEPA).

The geotechnical testing programs included approximately 1,400 natural moisture content determinations, 50 specific gravity determinations, 330 Atterberg limits determinations, 75 sieve analyses, 1,150 dry density determinations, 95 permeability tests, 27 constant rate of strain (CRS) consolidation tests, 29 incremental one-dimensional consolidation tests, 640 unconfined compression tests (UCC), 50 unconsolidated, undrained triaxial compression tests (UU), 25 isotropically consolidated undrained triaxial compression tests (CU), 215 drained triaxial compression tests, 20 K_o consolidated undrained triaxial compression tests (CK_oUC), 10 K_o consolidated undrained triaxial extension tests (CK_oUE), and one compaction test. The results of these tests are included within the geotechnical reports in **Appendix M**. Results of soil mechanics tests consisting of natural moisture content, unit weights, strength tests, and Atterberg limits are also shown in tabular form at the corresponding depths on the boring logs (**Appendix L**).

The natural moisture contents versus depth are plotted in **Figure 10**. The values ranged from 17 to 137 percent, with an average value of 43 percent.

Dry densities and total unit weights versus depth are plotted in **Figure 11** and **Figure 12**, respectively. Dry density values ranged from 34 to 108 pounds per cubic feet (lb/ft^3), with an average value of 77 lb/ft^3. Total unit weights varied from 90 to 120 lb/ft^3, with an average value of 107 lb/ft^3. (Refer to the histogram in **Figure 13**).

Results of specific gravity are summarized in **Table 2**, and are typical for the material types tested.

Sieve analyses results are summarized in **Figures 14** and **15**. The graphs generated for each individual sample tested are included within the geotechnical reports in **Appendix M**.

The results from the Atterberg limits determinations are summarized in terms of the plasticity chart on **Figure 16**. The natural levee clays (*i.e.*, clay samples obtained from depths less than 12 feet bgs) exhibit an average liquid limit of 57 percent with a standard deviation of 21 percent. The backswamp clays (*i.e.*, for samples obtained from depths between 12 and 60 feet bgs) exhibit an average liquid limit of 80 percent with a standard deviation of 23 percent.

The graphs produced for each individual consolidation test performed are included within the geotechnical reports in **Appendix M**.

The results of unconfined compression strength tests are plotted versus depth in **Figure 17**. The triaxial compression test results are summarized in **Figure 18**. The graphs generated for each individual sample tested for these strength determinations are included within the geotechnical reports in **Appendix M**.

Results of laboratory permeability tests indicate the following (as detailed in the 1999 Ardaman & Associates Report included in **Appendix K**): silt and sandy silt (ML) samples – permeability (geometric mean value) of 5×10^{-6} cm/sec; lean clay (CL) samples – permeability (geometric mean value) of 8×10^{-8} cm/sec; and highly plastic clay (CH) samples – permeability (geometric mean value) of 1×10^{-8} cm/sec. The geotechnical laboratory reports for each individual sample tested are included within the geotechnical reports in **Appendix M**.

d. geologic cross-section from available published information depicting the stratigraphy to a depth of at least 200 feet below the ground surface;

Figure 19 is a regional geologic cross-section for the area. The cross-section depicts the stratigraphy to a depth of over 200 feet bgs.

e. **for faults mapped as existing through the facility, verification of their presence by geophysical mapping or stratigraphic correlation of boring logs. If the plane of the fault is verified within the facility's boundaries, a discussion of measures that will be taken to mitigate adverse effects on the facility and the environment;**

There are no known recorded faults mapped as existing through the facility; therefore, LAC 33:VII.521.D.i.e is not applicable.

f. **for a facility located in a seismic impact zone, a report with calculations demonstrating that the facility will be designed and operated so that it can withstand the stresses caused by the maximum ground motion, as provided in LAC 33:VII.709.C.2; and**

The facility is not located in a seismic impact zone; therefore, LAC 33:VII.521.D.1.f is not applicable.

g. **for a facility located in an unstable area, a demonstration of facility design as provided in LAC 33:VII.709.C.3.**

The natural shallow fine-grained soils beneath the facility are inherently stable. The gypsum stacks have been and will continue to be constructed and operated in ways that will allow the soils to remain stable. The clays and clayey soils become more consolidated and stronger under the load of the gypsum stacks. Some subsidence has and will occur. These factors have been taken into account in the design of the facility, and are ordinary and routine factors to be considered in the design of gypsum facilities in Louisiana. The stacks have been designed to ensure structural integrity of all components of the facility for the protection of human health and the environment.

The Ardaman report dated 1999 in **Appendix K** presents the detailed design of the area encompassing Stacks 1 through 7. The detailed design for Stack 8 is presented in the 1992 Eustis Report in **Appendix M**.

2. **The following information regarding geology is required by Type III woodwaste, and construction/demolition-debris facilities:**

The gypsum stacks and associated areas are Type I facilities. Therefore, the above citation is not applicable.

E. Facility Subsurface Hydrology. Standards governing facility subsurface hydrology are contained in LAC 33:VII.715.A (Type I and II landfarms).

1. The following information on subsurface hydrology is required for all Type I facilities and Type II landfills and surface impoundments:

a. delineation of the following information for the water table and all permeable zones from the ground surface to a depth of at least 30 feet below the base of excavation:

i. areal extent beneath the facility;

From the soil boring logs (**Appendix L**), soil cross sections in **Appendix I** were constructed. The groundwater-bearing zones are identified on these cross-section figures as A-Silt, B-Silt, and C-Silt. Isopach maps are included in **Appendix N** showing the areal extent of each zone.

S2-1-E

As shown on the cross sections and isopach maps, the A-Silt is thin, discontinuous, and not considered a viable water-bearing zone. The B-Silt is the second permeable zone encountered beneath the site. The B-Silt is thicker and more continuous than the overlying A-Silt; however, it is not present across the entire site. The B-Silt is regarded as the uppermost continuous water-bearing zone beneath the site. The C-Silt is the third permeable zone encountered beneath the site. The C-Silt appears to be continuous across the entire site. The C-Silt is considered the second water-bearing zone beneath the site. Immediately underlying the C-Silt is a sand (Shallow Aquifer) deposit, which may be representative of river channel deposits or a point bar.

At most locations, it is difficult to distinguish between the A-Silt and the B-Silt (*i.e.*, at locations P-5, P-20, and P-22). Therefore, it was decided to determine if the A-Silt and the B-Silt are in hydraulic communication. To accomplish this task, two *temporary piezometers were installed* (February 17, 2005) in the A-Silt with hand-auger equipment at two B-Silt/C-Silt well cluster locations (P-13/P-21 and P-23/P-16). The boring logs for these two installations (GS-B1 at well cluster P-23/P-16 and GS-B2 at well cluster P-13/P-21) are included in **Appendix L**. After at least 24 hours after installation (February 18, 2005), the elevation of the casing tops of the temporary piezometers were surveyed and the water levels were measured at each well cluster and at nearby A-Silt well P-8. The groundwater elevation results are shown on **Table 5**. As shown on the table, potentiometric elevations in the A-Silt and the B-Silt are similar at both well cluster locations; therefore, it is concluded that the A-Silt and the B-Silt are considered as being interconnected and can be termed the A/B-Silt water bearing zone (aquifer). After water levels were measured, the temporary piezometers were removed and the boreholes grouted with a thick cement-bentonite mix.

ii. thickness and depth of the permeable zones and fluctuations;

The soil cross sections in **Appendix I** and isopach maps in **Appendix N** illustrate the thickness and elevation of each permeable zone. The A-Silt is a thin zone normally encountered approximately 6 to 10 feet bgs. It is thickest in the southern and eastern portions of the site. The B-Silt is normally encountered approximately 15 to 20 feet bgs, and ranges from 4 to 6 feet thick. The B-Silt appears thickest directly beneath the middle and northwest portions of the site. The C-Silt is normally encountered approximately 40 feet bgs, and ranges in thickness from 7 to 15 feet. However, it is substantially thicker in the southwest and eastern portions of the site. The dense sand zone (Shallow Aquifer) immediately beneath the C-Silt is normally encountered at approximately 55 feet bgs. The depth to the top of this zone encountered in each soil boring is illustrated in **Appendix L**.

iii. direction(s) and rate(s) of groundwater flow based on information obtained from piezometers and shown on potentiometric maps; and

Figure 20 and **Figures 21a** and **21b** show the location of the current existing piezometers and monitor wells at the site. **Table 3** summarizes construction data for each well/piezometer.

Appendix O presents potentiometric maps constructed from groundwater elevation data obtained from piezometers and monitor wells screened in each permeable zone. Note that only one well (P-8) is screened in the A-Silt, thereby providing insufficient data to construct potentiometric maps for this zone.

The A/B-Silt Potentiometric Maps (**Appendix O**) show that groundwater is flowing to the west, northwest, north, and northeast (somewhat radial). Referencing these maps, a depression exists in the vicinity of Stack 7 and directs groundwater towards well P-22. No apparent reason has been uncovered to explain this flow pattern. For the A/B-Silt Potentiometric Maps in **Appendix O**, the hydraulic gradient of the groundwater flow is on the order of about 0.003 feet per foot (ft/ft).

During October 2003, slug tests were performed in wells screened in the A/B-Silt (P-5, P-9, P-11, P-13, P-22, and P-23) groundwater zone to determine the hydraulic conductivity. The results of the slug tests are included in **Appendix Z**. The average hydraulic conductivity calculated for the A/B-Silt was 8.9×10^{-5} cm/sec (0.25 ft/day).

The mean rate of groundwater flow in the A/B-Silt was calculated based on the following formula (Darcy's Law):

V = Ki/n, where

V = Mean linear groundwater velocity (ft/day)
i = Hydraulic gradient (ft/ft)
n= Effective soil porosity (0.20 for the soil type)
K = Average hydraulic conductivity (ft/day)

V = (0.25 ft/day)(0.003) / 0.20

= 3.8×10^{-3} ft/day = 1.38 ft/yr

Therefore, based on the parameters described above, the average linear groundwater velocity in the A/B-Silt was calculated to be almost 1.5 ft/yr.

The C-Silt Potentiometric Maps (**Appendix O**) show that groundwater is flowing predominantly to the northeast, but also flows to the north/northwest and to the east on occasion. The hydraulic gradient of the groundwater flow is on the order of about 0.0008 ft/ft.

During October 2003, slug tests were also performed in wells screened in the C-Silt (P-12, P-14, P-15, P-17, P-19, and P-21) groundwater zone to determine the hydraulic conductivity. The results of these slug tests are also included in **Appendix Z**. The average hydraulic conductivity calculated for the C-Silt was 5.0 x 10^{-4} cm/sec (1.42 ft/day).

Using Darcy's Law with a hydraulic gradient of 0.0008 ft/ft, a porosity of 0.2, and a hydraulic conductivity of 1.42 ft/day, the average linear groundwater velocity in the C-Silt is calculated to be 2.06 ft/yr (about 2 ft/yr).

Referencing the Hydrogeologic Assessment Report prepared by Geraghty & Miller (February 5, 1987), velocities were calculated (using a porosity of 0.2 and a standard published hydraulic conductivity of 1 x 10^{-3} cm/sec) in the A/B-Silt and C-Silt Zones as 0.2 and 0.1 ft/yr, respectively. However, the report indicates that (based on solute transport modeling) the velocity in the A/B-Silt Zone could be approximately 73 ft/yr. Therefore, the calculated velocities above are within the range reported in 1987 by Geraghty & Miller.

The vertical groundwater potentiometric conditions are depicted on **Table 4**. Groundwater flow nets constructed from these data (May 2001, October 2001, November 2003, July 2004, and March 2005) are presented in **Appendix AA**. There appears to be a downward gradient from the A/B-Silt to the C-Silt during the fall months when the Mississippi River stage is low, and an upward gradient from the C-Silt to the A/B-Silt during the spring months when the Mississippi River stage is high.

iv. any change in groundwater flow direction anticipated to result from any facility activities.

Groundwater flow in the A/B- and C-Silt zones (within the upper approximately 50 feet of the subsurface) is predominantly to the north (away from the Mississippi River). In the immediate vicinity of the gypsum stacks (approximately 1.5 miles from the river), shallow groundwater flow (especially in the A/B-Silt) is altered, becoming somewhat radial towards the north due to groundwater "mounding" caused by water contained within the stacks. This partial radial flow pattern is observed only within the immediate vicinity of the gypsum stacks. Within only a very short distance from the stacks, the hydraulic influence that these surface features have on shallow groundwater is diminished, and the shallow groundwater movements return to the flow pattern observed in areas away from the gypsum stacks.

b. delineation of the following, from all available information, for all recognized aquifers which have their *upper surfaces within 200 feet of the ground surface:*

i. areal extent;

The shallowest most important source of groundwater near the site is the Gonzales Aquifer. Other aquifers present beneath the site include: the Shallow Aquifer and "400 foot" sand (which are above and below the Gonzales Aquifer, respectively). The "400 foot" sand is the equivalent to the "400 foot" sand of the Baton Rouge area. **Figure 22** presents a cross-sectional view of the site's subsurface to a depth of about 1,000 feet.

ii. thickness and depth to the upper surface;

Refer to **Figure 22**. The Shallow Aquifer extends from about 150 feet to 250 feet bgs. The underlying Gonzales Aquifer occurs from about 300 feet to 650 feet bgs. The "400-foot" sand is encountered at about 900 feet bgs.

iii. any interconnection of aquifers; and

As shown on **Figure 22**, beds of relatively impermeable clay separate these aquifers. The aquifers are not hydraulically connected directly. However, they may be hydraulically connected to the Mississippi River.

iv. direction(s) and rate(s) of groundwater flow shown on potentiometric maps.

Water levels in aquifers in the area range from a few feet above to as much as 20 feet or more below land surface (Long, 1965). The major cause of water-level fluctuations in the aquifers is change in the stage level of the Mississippi River. As river stage increases, piezometric levels in the aquifers increase near the river, and the piezometric surface slopes away from the Mississippi River. During periods of low river stage, piezometric levels near the river decrease, and the piezometric surface slopes toward the Mississippi River.

The potentiometric surface of the regional aquifer is shown on **Figures 23a** through **23c**. Based on these figures, the gradients and velocities are calculated using the following formulas:

$i = h/L$, where
- i = hydraulic gradient
- h = difference in piezometric elevation
- L = horizontal distance

$V = ki/n$, where
- V = velocity
- k = hydraulic conductivity (1×10^{-3} cm/sec)
- n = effective porosity (0.2)
- i = hydraulic gradient

At low river stage (October 1960) - flow towards Mississippi River:

i = 4 ft/8 mi x 5280 ft/mi = 0.0001 ft/ft
$v = (1\times10^{-3})(0.0001)/0.2=4.7\times10^{-7}$ cm/sec = 0.5 ft/yr

At high river stage – flow away from Mississippi River:

i (1979) = 4 ft/8000 ft = 0.0005 ft/ft
i (1961) = 8 ft/8 mi x 5280 ft/mi = 0.0002 ft/ft
average i = 0.00035 ft/ft
$v = (1\times10^{-3})(0.00035)/0.2=1.7\times10^{-6}$ cm/sec = 1.8 ft/yr

The flow directions are consistent with Long, 1965. Also, these velocities are similar to those calculated above for the A/B-Silt (1.5 ft/yr) and C-Silt (2 ft/yr) Zones.

As documented in the literature, vertical groundwater flow in the Shallow Aquifer is upward. Potentiometric levels in the C-Silt during low river stage are typically below 5 feet, National Geodectic Vertical Datum (NGVD). Potentiometric levels in the Shallow Aquifer in the vicinity of PCS Nitrogen during low river stage in October 1960 ranged between 4 and 6 feet, MSL. During high river stage in April 1961 and October 1979, the potentiometric elevations for the Shallow Aquifer in the vicinity of PCS Nitrogen ranged between 20 to 25 and 8 to 11 feet MSL, respectively. Typically, potentiometric elevations in the C-Silt during high river stage range between 8 to 15 feet NGVD. In summary, it is difficult to definitively compare the C-Silt and Shallow Aquifer potentiometric levels due to the absence of well clusters in these zones. However, existing data and published literature suggest an upwards vertical gradient.

2. **The following information on subsurface hydrology is required for Type II landfarms. Delineation of the following information for the water table and all permeable zones from the ground surface to a depth of at least 30 feet below the zone of incorporation:**

The gypsum stacks and associated areas are Type I facilities. Therefore, this citation is not applicable.

F. **Facility Plans and Specifications. Standards governing facility plans and specifications are contained in LAC 33:VII.711.B (Type I and II landfills), LAC 33:VII.713.B (Type I and II surface impoundments), LAC 33:VII.715.B (Type I and II landfarms), LAC 33:717.E (Type I-A and II-A facilities), LAC 33:VII.721.A (Type III construction and demolition debris and woodwaste landfills), LAC 33:VII.723.A (Type III composting facilities), and LAC 33:VII.725.A (Type III separation facilities). Standards for groundwater monitoring are contained in LAC 33:VII.709.E (Type I and II facilities).**

1. **Certification-The person who prepared the permit application must provide the following certification:**

   "I certify under penalty of law that I have personally examined and I am familiar with the information submitted in this permit application and that the facility as described in this permit application meets the requirements of the Solid Waste Rules and Regulations. I am aware that there are significant penalties for knowingly submitting false information, including the possibility of fine and imprisonment."

   The required certification is located in **Appendix P**.

   In accordance with LAC 33:VII.509, a certification report shall be sent to the LDEQ for approval prior to the placement of waste in a newly constructed cell.

2. **The following information on plans and specifications is required for Type I and II facilities:**

   a. **detailed plan-view drawing(s) showing original contours, proposed elevations of the base of units prior to installation of the liner system, and boring locations;**

      Boring locations are presented in section D.1.b.

      The west unit is an existing gypsum stacking facility. The original contours of the east unit are shown on the survey map, **Figure 24**.

   b. **detailed drawings of slopes, levees, and other pertinent features; and**

      Final contour drawings for the west unit are included in **Appendix B (Figure 6)**. Final contour drawings for the east unit are included in **Appendix B (Figure 8)**.

S2-F

Drawings of the slope of the gypsum stacks in the west unit over the remaining life of the unit are also shown in **Appendix B** (**Figure 1**, **Figure 3** through **Figure 6**).

Typical cross-sections for the construction of dikes and levees in the east and west units are shown in **Appendix B** (**Figure 2** and **Figure 7**).

c. the type of material and its source for levee construction. Calculations shall be submitted demonstrating that an adequate volume of material is *available for the required levee construction.*

The levees in the west unit are already constructed. Cross-sections of the west unit perimeter levees are shown in **Appendix B** (**Figure 2**). The levees of the east unit, which will be constructed of clay, will be constructed prior to commencing operations in Stack 8. Although the Geotechnical Investigation for Stack 8 performed by Eustis Engineering, which is located in **Appendix M** and depicted on **Figure 25**, demonstrates that adequate clay for levee construction can be obtained from on-site, PCS Nitrogen will obtain the necessary clay from a commercial source.

The levee material that will be required for Stack 8 is approximately 70,000 cubic yards.

3. The following information on plans and specifications is required for Type I, II, and III landfills:

a. approximate dimensions of daily fill and cover; and

Daily fill will average about 60,000 cubic feet per day of gypsum. No daily cover will be applied. However, for interim and final cover a soil and grass cover is being installed on existing inactive stacking areas and on the lower reaches of active stacking areas in an on-going program in accordance with the regulations.

The surface area on which cover is added varies and will decrease as the inactive areas are finally covered, and only newly created inactive areas are without cover.

b. ***the type of cover material and its source for daily, interim, and final cover. Calculations shall be submitted demonstrating that an adequate volume of material is available for daily, interim, and final cover.***

Commercial sources of clay are available and will be utilized in order to maintain on-site clay requirements.

4. **The following information on plans and specifications for the prevention of groundwater contamination must be submitted for Type I and II facilities:**

a. **representative cross-sections and geologic cross-sections showing original and final grades, approximate dimensions of daily fill and cover, drainage, the water table, groundwater conditions, the location and type of liner, and other pertinent information;**

Typical cross-sections are shown in **Appendix B** (**Figure 2** and **Figure 7**).

Where applicable, the liner will be overlain in a shingle fashion. For locations where piping extends through the landfill, a HDPE "boot" or equivalent method will be used as shown in **Appendix B**, **Figure 2**.

Because of the nature of the gypsum disposed and its similarity to silty/sandy soils, PCS Nitrogen does not propose the application of daily cover. Gypsum is neither putrescible nor odorous, nor does the material attract vectors.

The management of non-contact storm water run-off involves directing flow away from the gypsum stacks into the perimeter ditch system (**Appendix B**, **Figure 1**), and ultimately discharging the storm water through permitted internal Outfall 301 and then ultimately through permitted external Outfall 001. The system is designed to accommodate the flow from the gypsum stacking area resulting from a 24-hour, 25-year storm event.

A description of groundwater conditions is discussed in response to LAC 33:VII.521.E. Groundwater monitoring reports have been submitted to the LDEQ since 1991.

b. a description of the liner system, which shall include: calculations of anticipated leachate volumes, rationale for particular designs of such systems, and drawings; and

Contamination of groundwater is prevented by the naturally occurring, low-permeability clay under the gypsum stacks (Stacks 1 through 7) as shown in **Appendix I**. The rationale for the design of the liner system is based on the physical characteristics of the gypsum stack and the existing clay. Besides sulfate, the main potential groundwater pollutants from a gypsum facility are orthophosphate and fluoride, both of which migrate through clay very slowly and with great difficulty. Clay is an excellent barrier for both species. In addition, the clay has a very low permeability to water. Finally, a clay liner has the flexibility to deform under subsidence without destroying the integrity of the barrier to groundwater.

The constructed liner system for Stack 8 will consist of 2 feet of recompacted clay (permeability no greater than 10^{-8} cm/sec) overlain with a 60-mil HDPE Liner as shown in **Appendix B** (**Figure 7**).

Leachate calculations for Stack 8 were performed using the USEPA's Hydrologic Evaluation of Landfill Performance (HELP) Model to approximate the volume of leachate to be generated, and the depth of leachate head on the liner. Based on the analysis, there will be little or no head on the liner during the post-closure period. This is largely due to the high efficiency of the cover system that removes approximately 99.8 percent of the precipitation falling on the facility. The results of the HELP Model are included in **Appendix B**.

Construction specifications for the gypsum stacks are also included in **Appendix B** (Clay Liner Quality Assurance/Quality Control Plan). The specifications call for full-time earthwork inspection, field and laboratory tests, and periodic engineer visits.

The interim soil and grass cover will be implemented throughout the life of the facility.

The anticipated leachate volumes are shown in **Appendix Q**. Also included in **Appendix Q** (Analysis of Stack Liner Drains) is the approved analysis for the stack liner drains that evaluates pipe size, classification, deflection, and design capacities. See also **Appendix B** (Phase Drawings and Drainage and Run-Off Drawings). Additional calculations are included in **Appendix Q**. The calculation is the initial baseline evaluation used during the current gypsum stacking operation Phase 10, Stack 3/7 – HDPE lined Stage 1, cells, 2A, 2B, 2C, and 2D. The common stacking commitment will be continued via Phase II, which will maintain the current design for side slopes and height criteria and liner drains. **Appendix B** drawings also depict the proposed four cell stacking configuration for Stack 8. They depict the estimated piping and drainage infrastructure consistent with current gypsum stacking operations with the side slope and height criteria consistent with the baseline evaluation employed for Phase 10 stacking. The proposed future operational Phase 11 stacking modifications with projected piping infrastructure are also depicted.

Slope stability analyses have been performed and the analyses and results for the area encompassing Stack 1 through Stack 7 are included in the 1999 Ardaman Report in **Appendix K**. The slope stability analysis for the proposed final elevation of 220 feet is included in the Addendum to the 1999 Ardaman Report (See **Appendix K**). The slope stability analyses and results for Stack 8 are included in the 1992 Eustis Report in **Appendix M (Report P)**.

Also included in **Appendix K** is an Ardaman Memorandum and drawings (**Figure A1** and **Figure A3**) that indicate plan and sections with stability graphics for the previous Phase 9 6(h) to 1(v) slope and the current Phase 10 3(h) to 1(v) slope stacking criteria.

The operational design based on the proposed maximum elevation (210 feet MSL) are detailed in **Appendix B** Drawings and supporting calculations are provide in **Appendix Q**.

An extensive monitoring system consisting of piezometers and inclinometers is utilized to detect ground movements.

Bearing capacity is addressed by the stability analyses. It has been concluded that base soils should provide adequate support, and bearing failure should not occur.

Settlement analyses were also performed. The analyses and calculations for the area encompassing Stack 1 through Stack 7 are included in the 1988 and 1994 Eustis Reports (**Appendix M**) and in the 1999 Ardaman Report in

Appendix K. The settlement analyses and calculations for Stack 8 are included in the 1992 Eustis report (**Appendix M**). Settlement for the area encompassing Stack 1 through Stack 7 is estimated to be as large as 12 feet, 50% of which is expected to occur during initial stacking. The results of the settlement analyses (conservatively) show that ultimate settlement beneath the central area of Stack 8 may be on the order of 5 to 8 feet, 40% of which is expected to occur over about a 3 to 5-year period during the placement of gypsum (and the remainder will occur over many years).

c. **a description of the leachate collection and removal system, which shall include calculations of anticipated leachate volumes, rationale for particular designs of such systems, and drawings.**

There are three kinds of leachate collection systems: (1) collection of leachate in toe drains around the Inactive Clearwell; (2) collection of leachate from the lower sides and bases of the stacked gypsum in the perimeter ditches, internal ditches, and clearwells; and (3) under drains from areas lined with HDPE.

The leachate removal system consists of the toe drains, ditches, clearwells, and pumps. Leachate that drains into a ditch of an active stacking area is sent to the Active Clearwell for use as process water.

Anticipated leachate volumes are included in **Appendix Q**.

Leachate drains out of the stacks and is collected in the interceptor ditch toe drain collection system surrounding the facility. **Appendix B (Figure 1)** shows the interceptor ditches.

The decant ditches and the leachate collection system are designed to prevent run-off of rainfall from the facility and to cut off lateral movement of seepage from the stacks. These design elements are standard within the industry.

An under drain with HDPE perforated pipe will be installed beneath Stack 8. The location is shown on **Appendix B (Figure 7)**.

An annual analysis of leachate from the gypsum stacks will be performed for the same parameters included in the groundwater monitoring program in accordance with 711.B.4.b.iv.

Appendix B (Drainage and Run-Off Drawings) includes the Phase 10 liner and liner drains. (Certified submittals for Cells 1 and 2A have been approved by LDEQ.)

Also included in **Appendix B** (Drainage and Run-Off Drawings) are the drawings indicating site locations for storm water runoff design capacities for the perimeter HDPE-lined ditch and slope runoff collector ditch system. The combined ditch capacities of 19.3 mm gallon along with a 70 mm gallon retention capacity of the new inactive clearwell will provide adequate run-off control for a design 9.9 inch storm (approximately 25-year 24-hour storm event).

Appendix C includes a May 26, 2000 LDEQ approval regarding the ditch system. The lined section of the perimeter ditch is maintained at an invert elevation of 13 feet MSL, and a dike crest elevation of 18.2 feet MSL with a capacity of 10.7 MM gallons. The current site pumping capacity is 12,500 gpm.

The calculations (rational) for the size of the leachate pipes are included in **Appendix Q**. The calculations for the design loads and sizing of leachate piping for Stack 8 are also included in **Appendix Q.**

5. **The following information on plans and specifications for groundwater monitoring must be provided for Type I and II facilities:**

   a. **a minimum of three piezometers or monitoring wells in *the same zone must be provided in order to determine* groundwater flow direction;**

   As previously discussed in LAC 33:VII.521.E, the A/B-Silt is the shallowest permeable zone that extends beneath the majority of the facility area. The C-Silt is below the A/B-Silt and is the shallowest permeable zone that extends beneath the entire facility area. Therefore, the A/B-Silt and the C-Silt zones are monitored, because these strata are the most likely to be affected if contaminant migration occurs.

   Referring to the A/B-Silt zone Potentiometric Maps in **Appendix O**, groundwater is flowing to the west, northwest, north, and northeast (somewhat radial). Therefore, existing piezometers/monitor wells P-4, P-5, P-7, P-8, P-9, P-11, P-13, P-20, P-22, and P-23, which are located around the perimeter of the area encompassing Stacks 1 through 7, will determine groundwater flow direction in the A/B-Silt zone. These monitoring points are located on **Figure 21a**. In addition, new piezometers/monitor wells P-B1 through P-B22 will be installed around the perimeter of the gypsum stacks to supplement the existing well data concerning groundwater flow direction in the A/B-Silt zone. These wells will be screened in the A/B-Silt zone.

Referring to the C-Silt zone Potentiometric Maps in **Appendix O**, groundwater is flowing predominately to the northwest, but also flows to the north/northwest and to the east on occasion. Therefore, existing piezometers/monitor wells P-6, P-12, P-14, P-15, P-17, P-18, P-19, and P-21, which are located around the perimeter of the area encompassing Stacks 1 through 7, will determine groundwater flow direction in the C-Silt zone. These monitoring points are located on **Figure 21b**. In addition, new piezometers/monitor wells P-C1 through P-C21 will be installed around the perimeter of the gypsum stacks (**Figure 21b**) to supplement the existing well data concerning groundwater flow direction in the C-Silt zone. Because the regulatory maximum allowed screen length is exceeded for wells P-10 and P-16, well P-10 will be replaced with well P-C17, and P-16 will be replaced with well P-C20 (**Figure 21b**). These wells are or will be screened in the C-Silt zone. Immediately prior to construction of Stack 8, well P-19 will be plugged and abandoned.

The piezometer/monitor well cross sections are included as **Appendix R** and summarized on **Table 3**. As shown on these cross-section diagrams, the wells are constructed of 4-inch diameter schedule 40 polyvinyl chloride (PVC) pipe. Each well includes a 5- to 15-foot screened interval constructed of 4-inch diameter schedule 40 PVC with a slot size of 0.010 inches. The proposed new wells will be installed in accordance with the Monitor Well Installation Plan (**Appendix BB**).

As shown on the Potentiometric Maps in **Appendix O**, numerous wells screened in the C-Silt zone occasionally exhibit free-flowing conditions. PCS Nitrogen will review alternate approaches to prevent these free-flowing conditions and implement a method acceptable to the LDEQ.

The placement and construction of the existing wells and the proposed wells are designed to detect contamination emanating from the facility. The wells were placed as close to the stacks as practicable, and screened in the stratum most likely to be affected by contaminant migration.

PCS Nitrogen will operate and maintain these wells to perform to design specifications throughout the life of the monitoring program.

b. **for groundwater monitoring wells, cross-sections illustrating construction of wells, a scaled map indicating well locations and the relevant point of compliance, and pertinent data on each well, presented in tabular form, including drilled depth, the depth to which the well is cased, screen interval, slot size, elevations of the top and bottom of the screen, casing size, type of grout, ground surface elevation, etc.;**

Cross-sections illustrating well construction details and pertinent data on each well, presented in tabular form, including drilled depth, the depth to which the monitoring well is cased, screen interval, slot size, elevations of the top and bottom of the screen, casing size, type of grout, ground surface elevation, *etc.*, are included as monitoring well cross-sections, **Appendix R**, and **Table 3**.

The relevant point of compliance in the A/B-Silt zone underlying the gypsum stacks is the vertical surface of the facility's exterior boundaries and extends down into the A/B-Silt zone underlying the gypsum stacks. The A/B-Silt wells are downgradient and yield groundwater samples from the A/B-Silt that represent the quality of groundwater passing the relevant points of compliance.

The relevant point of compliance in the C-Silt zone underlying the gypsum stacks is the vertical surface of the facility's exterior boundaries and extends down into the C-Silt zone underlying the gypsum stacks. These C-Silt wells are downgradient and yield groundwater samples from the C-Silt that represent the quality of groundwater passing the relevant points of compliance.

These compliance points are located on property owned and controlled by PCS Nitrogen and are shown on **Figures 21a** and **21b**. These compliance points were selected based on the required factors as detailed in LAC 33:VII.709.E.1.a. These eight factors are identified below:

1. Hydrological characteristics of the facility and the surrounding land;

   Based on the results of soil borings, the generalized shallow subsurface geology consists primarily of low-permeability clays and silts and fine sand. Geologic

Cross-Sections (**Appendix I**) and an Isometric Soil Profile (**Appendix J**) were constructed based on these results. The soil boring logs are included as **Appendix L**. The wells were and will be installed based on the results of these soil borings.

2. Volume and physical and chemical characteristics of the leachate;

   Calculations on volume of leachate are included in **Appendix Q**. The waste analysis is included in Section 521.H.1.a. Gypsum is a mineral processing waste that is regulated as non-hazardous. Moisture of the total waste stream is high; therefore, airborne contaminants are minimized [there is however a National Emission Standards for Hazardous Air Pollutants (NESHAP) applicable to the gypsum stacks].

3. The quality and direction of flow of groundwater in the uppermost aquifer;

   Based on semi-annual groundwater sampling that PCS Nitrogen has conducted in the A/B-Silt and C-Silt zones underlying stacks 1 through 7 since 1991, groundwater quality in the A/B-Silt Zone has been affected in zones underlying Stacks 1 through 7. Groundwater in the A/B-Silt zone at isolated locations (P-5, P-7, P-8, and P-11) contains elevated concentrations of sulfate. PCS Nitrogen is in the process of implementing an assessment work plan approved by the LDEQ. Information regarding direction of flow is provided in LAC 33:VII.521.E.1.a.iii.

4. The proximity and withdrawal rate of the groundwater users;

   The locations of groundwater wells in the proximity of the facility are provided in **Figure 5**.

5. Availability of alternative drinking water supplies;

   It is not expected that the A/B-Silt and C-Silt zones would ever be used as a source of drinking water due to the low recharge rate. Better quality water and greater quantities of water exist in deeper aquifers.

6. Existing quality of the groundwater, including other sources of contamination and their cumulative impacts on the groundwater, and whether the groundwater is currently used or reasonably expected to be used for drinking water;

   Based on semi-annual groundwater sampling that PCS Nitrogen has conducted in the A/B-Silt and C-Silt zones underlying stacks 1 through 7 since 1991, groundwater quality in the A/B-Silt zone has been affected in isolated locations (P-5, P-7, P-8, and P-11) by elevated concentrations of sulfate. PCS Nitrogen is in the process of implementing an assessment work plan approved by the LDEQ. No other sources of potential groundwater contamination are in the vicinity of the gypsum stacks. The groundwater in the A/B-Silt and C-Silt zones underlying the gypsum stacks is currently not used, nor is it reasonably expected to be used, for drinking water. Groundwater used for public supply, industrial usage, and/or irrigation is taken primarily from the Gonzales Aquifer.

7. Public health, safety, and welfare effects; and

   PCS Nitrogen anticipates no adverse impact on the public health, safety, or welfare due to operation of the gypsum stacks. The groundwater monitoring system is designed to detect potential groundwater contamination at the earliest possible opportunity.

8. Practicable capability of the owner or operator.

   There are no known factors prohibiting PCS Nitrogen's practicable capability of selecting the relevant point(s) of compliance.

   The groundwater monitoring system for the gypsum stacks will be comprised of existing and proposed groundwater monitoring wells. Many of the existing wells were installed before 1987, prior to promulgation of "Water Well Rules, Regulations, and Standards, State of Louisiana" (LAC 70:XIII).

   After the installation of the proposed monitoring wells, the groundwater sampling and analysis plan will be modified to include the new wells.

Well construction diagrams of the existing wells are included in **Appendix R**. Each of the wells is or will be vented to the atmosphere and sealed with concrete to prevent surface contamination. The wells are or will be screened and located to insure that only one water-bearing unit is sampled per well. Each well is or will be protected by a steel casing and locked to prevent tampering.

All wells have or will have protective casings with locking covers and a secure locking device in place, guard posts firmly anchored outside the well slab, but not in contact with the slab, and a screen length not more than 10 feet. In addition, the wells allow or will allow at least 3 inches between the well casing and the borehole wall.

Each well has or will have a plate permanently affixed to each well's protective casing to prominently display each well's identification number, identification as upgradient or downgradient, elevation of top of well casing in relation to MSL or equivalent, screen depth in relation to MSL or equivalent, and date of well installation. The site groundwater contact person will maintain information regarding well repairs.

PCS Nitrogen will obtain approval from LDEQ prior to the construction of any future monitor wells associated with the facility. The wells will be installed in accordance with the Monitor Well Installation Plan (**Appendix BB**). Within 90 days after construction of any monitor well associated with the facility, PCS Nitrogen will submit well-completion details to verify that the wells were constructed according to the approved specifications and to document construction procedures. The well-completion details will include daily field notes documenting construction procedures and any unusual occurrences such as grout loss, *etc.*; the boring log for each well including surface elevation(s) with respect to MSL; and as-built diagrams for each well showing all pertinent features such as elevation of reference point for measuring groundwater levels, screen interval, and ground surface. If features change from the LDEQ approved plans, then a permit modification request will be submitted in accordance with LAC 33:VII.517.

c. **groundwater monitoring program including a sampling and analysis plan that includes consistent sampling and analysis procedures that ensure that monitoring results provide reliable indications of groundwater quality;**

PCS Nitrogen's Groundwater Sampling and Analysis Plan (**Appendix S**) includes consistent sampling and analysis procedures that ensure that monitoring results provide reliable indications of groundwater quality at the background and downgradient well locations. PCS Nitrogen's Groundwater Sampling and Analysis Plan will be reviewed annually and revised if necessary.

d. ***for an existing facility,*** **all data on samples taken from monitoring wells in place at the time of the permit application must be included. (If this data exists in the Solid Waste Division records, the administrative authority may allow references to the data in the permit application.) For an existing facility with no wells, groundwater data shall be submitted within 90 days after the installation of monitoring wells. For a new facility, groundwater data (one sampling event) shall be submitted before waste is accepted;**

Data from existing wells P-4 through P-23 has been submitted to the Solid Waste Division of the LDEQ. A summary of these historical analytical results is included as **Appendix CC**. For the updated groundwater monitoring system described above and also in the event additional groundwater monitoring parameters are added to those already listed or new monitoring wells are installed, PCS Nitrogen will complete an initial sampling event. The initial sampling event will be a minimum of four independent samples collected for each parameter. These samples will be collected quarterly over a period of one year in order to reflect seasonal variations in groundwater quality. It is understood that some statistical methods require more than four independent samples for the method to be valid.

e. **a plan for detecting, reporting, and verifying changes in groundwater; and**

The Groundwater Sampling and Analysis Plan, which includes procedures for detecting, reporting, and verifying changes in groundwater, is included as **Appendix S**.

The statistical method used in evaluating groundwater quality data will be selected based on the nature of the data and with the concurrence of the LDEQ. This evaluation is conducted separately for each parameter or constituent in each well.

PCS Nitrogen acknowledges that final approval for the statistical method chosen will be granted by LDEQ based on the technical merit and appropriateness of the method.

If deemed necessary by the LDEQ, PCS Nitrogen will submit revised statistical method(s) to the LDEQ as a permit modification within ninety (90) days after completion of the initial sampling event, or within 90 days of the date of issuance of the final permit if the existing sampling data is considered the initial sampling event. This permit modification will include the data collected from the initial sampling event, the proposed statistical method chosen for each parameter, and justification for choosing the proposed statistical method(s). This justification will provide verification of the underlying statistical assumptions and demonstrate that the statistical method chosen for each individual parameter is the most appropriate method based on the analytical data set that was generated from the initial sampling event.

PCS Nitrogen will conduct an assessment monitoring program at the facility when significant increases are determined, according to LAC 33:VII.709.E.3.f.i-iv, for one or more of the parameters or constituents sampled and analyzed during the detection monitoring program. The assessment monitoring parameters or constituents will consist of the detection monitoring parameters or constituents.

Within 90 days after triggering an assessment monitoring program, PCS Nitrogen will sample and analyze the groundwater at all wells for all the assessment monitoring parameters or constituents.

If an assessment monitoring program obligation is triggered and assessment monitoring parameters or constituents are detected at concentrations significantly different from background in the re-sampling event, PCS Nitrogen will, within 14 days, submit a report to LDEQ identifying the assessment monitoring parameters or constituents that are statistically different from background concentrations. PCS Nitrogen also will notify all persons who own land or reside on the land that directly overlies any part of the plume of contamination if contaminants have migrated off site as indicated by the sampling of the wells according to LAC

33:VII.709.E.8.c. (i).

PCS Nitrogen will, upon consultation with and approval of LDEQ, implement any interim measures necessary to ensure the protection of human health and the environment. The interim measures will be in accordance with LAC 33:I.Chapter 13.

PCS Nitrogen will consider the following factors in determining whether interim measures are necessary: time required to develop and implement a final remedy; actual or potential exposure of nearby populations or environmental receptors to hazardous parameters or constituents; actual or potential contamination of drinking water supplies or sensitive ecosystems; further degradation of the groundwater that may occur if remedial action is not initiated expeditiously; weather conditions that may cause hazardous parameters or constituents to migrate or be released; risks of fire or explosion, or risks of exposure to hazardous parameters or constituents as a result of an accident or failure of a container or handling system; and other situations that may pose threats to human health and the environment.

If a corrective-action plan is deemed necessary, PCS Nitrogen will perform corrective action at the facility in accordance with LAC 33:VII.709.E.9 and LAC 33:I.Chapter 13.

PCS Nitrogen will, within 270 days after the submittal of the assessment plan, submit to LDEQ four bound copies (8½ by 11 inches) of a corrective-action plan to remediate the groundwater. The corrective-action plan will describe the selected remedy and also will include a corrective-action groundwater monitoring program that meets the requirements of an assessment monitoring program outlined in LAC 33:VII.709.E.8, which indicates the effectiveness of the corrective-action remedy. In addition, the corrective-action plan will include a schedule for initiating and completing remedial activities.

After a corrective-action plan submitted by PCS Nitrogen has been approved by the LDEQ, the facility will implement the corrective-action program based on the schedule for initiating and completing remedial activities contained within the plan.

f. **the method for plugging and abandonment of groundwater monitoring systems.**

As discussed above, well P-19 will be plugged and abandoned. Also, wells P-10 and P-16 will be plugged/abandoned and replaced with wells P-C17 and P-C20, respectively.

PCS Nitrogen will comply with "Water Well Rules and Regulations, State of Louisiana" (LAC 70:XIII), as adopted by the LDOTD, Water Resources Section, for all plugging and abandonment of wells and holes including observation wells, monitor wells, piezometer wells, leak detection wells, assessment wells, recovery wells, abandoned pilot holes, test holes, and geotechnical boreholes.

6. **The facility plans and specifications for Type I and II landfills and surface impoundments (surface impoundments with on-site closure and a potential to produce gases) must provide a gas collection and treatment or removal system.**

Gas is nonexistent in the gypsum stacks due to the inorganic and non-putrescible nature of the waste. Therefore, gas control measures are not proposed for this facility.

G. **Facility Administrative Procedures. Standards governing facility administrative procedures are contained in LAC 33:VII.711.C (Type I and II landfills), LAC 33:VII.713.C (Type I and II surface impoundments), LAC 33:VII.715.C (Type I and II landfarms), LAC 33:VII.717.F (Type I-A and II-A facilities), LAC 33:VII.721.B (Type III construction and demolition debris and woodwaste landfills), LAC 33:VII.723.B (Type III composting facilities), and LAC 33:VII.725.B (Type III separation facilities).**

1. **The following information on administrative procedures is required for all facilities:**

a. **recordkeeping system; types of records to be kept; and the use of records by management to control operations;**

The annual disposal report required by Section 711.C.1.a. of the regulations is included in **Appendix T**.

Records of inspections and recommendations made by PCS Nitrogen's geotechnical consultants are maintained by the Engineering Department and are used to ensure that facility operations are appropriate.

Records of gypsum produced and deposited within the facility will be maintained. These records will be used to monitor rate-of-rise of the stacking areas and to estimate remaining life of the area.

Records of the type and quantity of authorized non-gypsum, nonhazardous solid waste ("related wastes") will be kept for reporting purposes and to provide a record of waste location to facilitate future recovery of gypsum for beneficial use when recovery for beneficial use is possible and is actually undertaken.

Records of the different procedures tested for installation of the soil and grass cover and of the tests that show the effects of the cover on infiltration reduction and quality of rainfall run-off will be maintained for at least three years. These records will be used to determine the best procedures for grass cover installation.

The Environmental Department will maintain completed facility inspection forms.

In addition to the above, the recordkeeping system currently contains and will continue to contain the following:

1. A copy of the current Solid Waste Rules and Regulations
2. A copy of the permit application
3. A copy of the permit
4. A copy of any permit modifications
5. Certified field notes for construction
6. Operator training programs
7. Daily logs
8. Quality Assurance/Quality Control records
9. Inspections by permit holder/operator
10. Records demonstrating that liner/leak-detection/cover systems are constructed/installed in accordance with appropriate assurance procedures
11. Monitoring, testing or analytical data
12. NDPES (LPDES) discharge monitoring data
13. A copy of the groundwater monitoring reports (groundwater sampling results)
14. Leachate volumes
15. Leachate sampling results
16. Post-closure monitoring reports
17. A record of releases from the facility
18. A copy of the facility contingency plan
19. A copy of the Calcium Sulfate Storage Pile Operating Plan (CSSPOP)
20. Any other documents received from/submitted to the LDEQ

PCS Nitrogen will maintain records for the life of the facility and keep records on file for at least three years after closure.

b. an estimate of the minimum personnel, listed by general job classification, required to operate the facility; and

One contractor site manager and approximately fifteen contractor and maintenance support personnel are required to operate the facility on a daily basis.

The minimum number of personnel required for monitoring and coordinating with the Phosphoric Acid Plant is one (the Phosphoric Acid Plant shift supervisor on duty). The gypsum facility is actually an essential part of the phosphoric acid manufacturing process in that water used to transport the gypsum to the facility must be returned to the phosphoric acid plant for use as process water. In addition, the phosphoric acid operating personnel will monitor and inspect the operation of the facility and coordinate facility operations with phosphoric acid plant operations. The person responsible for monitoring, inspecting, and coordinating activities is the phosphoric acid shift supervisor on duty, who may utilize shift workers for these tasks.

Overall supervision and planning requires one person to be responsible for both the phosphoric acid plant and the gypsum facility. That person currently is the Production Manager – Phosphate.

The minimum number of maintenance personnel required to maintain the equipment of the facility is one. As a practical matter, maintenance is the responsibility of the Maintenance Manager, who has at his disposal the entire maintenance staff for use at the facility, as required.

The minimum number required for engineering management is one, currently the Manager of Engineering Services, or designee. The manager of Engineering Services is responsible for selecting and directing the work of the geotechnical consulting firms.

c. **maximum days of operation per week and per facility operating day (maximum hours of operation within a 24-hour period).**

The facility operates 24 hours a day, 7 days a week.

2. **Administrative procedures for Type II facilities shall include the number of facility operators certified by the Louisiana Solid Waste Operator Certification and Training Program (R.S. 37:3151 et seq.).**

Not Applicable. PCS Nitrogen is a Type I solid waste disposal facility.

H. Facility Operational Plans. Standards governing facility operational plans are contained in LAC 33:VII.711.D (Type I and II landfills), LAC 33:VII.713.D (Type I and II surface impoundments), LAC 33:VII.715.D (Type I and II landfarms), LAC 33:VII.717.G (Type I-A and II-A facilities), LAC 33:VII.721.C (Type III construction and demolition debris and woodwaste landfills), LAC 33:VII.723.C (Type III composting facilities), and LAC 33:VII.725.C (Type III separation facilities).

1. The following information on operational plans is required for all facilities:

a. types of waste (including chemical, physical, and biological characteristics of industrial wastes generated on-site), maximum quantities of wastes per year, and sources of waste to be processed or disposed of at the facility;

MATERIALS THAT ENTER THE GYPSUM FACILITY

<u>Phosphogypsum</u>

Phosphogypsum ("gypsum") is generated as a result of from the manufacture of phosphoric acid by the wet process. The maximum amount is approximately 1.1 million tons per year on the dry basis of gypsum. Approximately 4.8 tons of gypsum (dry basis) are produced for every ton of phosphoric acid expressed as P_2O_5. See **Appendix H** for waste analysis.

Phosphogypsum generated as a result of PCS Nitrogen's phosphoric acid manufacturing process is exempt from the hazardous waste regulations under the mineral processing or "Bevill" exclusion under Resource Conservation and Recovery Act (RCRA), authorized by 42 U.S.C. § 6921(b)(3)(C) and set forth in the Code of Federal Regulations (C.F.R.) at 40 C.F.R. § 261.4(b)(7)(ii)(D) and in LAC 33:V.105.D.2.h.iv.

A typical analysis of gypsum is as follows:

5 2 1 H

Parameter	Concentration
$CaSO_4$:2H2O	92.84%
$Ca_3\ (PO_4)_2$	2.25 %
CaF_2	2.66%
SiO_2	0.95%
Fe_2O_3	0.01%
Al_2O_3	0.79%
Other Impurities	0.50%
Total Impurities	7.16%
pH (In 10% Water Slurry)	2.4 – 6.4

Process Water

Process water that is used in the manufacture of phosphoric acid is also used to transport gypsum to the facility as a slurry in a pipeline. The slurry is approximately 30% gypsum and 70% process water; therefore, considerably more process water than gypsum is delivered to the facility. The water decants off when the slurry is deposited on the stack and leaves the gypsum at about 22% moisture. The remainder of the process water is returned to the phosphoric acid plant.

Process water from PCS Nitrogen's phosphoric acid production process is exempt from the hazardous waste regulations under the mineral processing or "Bevill" exclusion under RCRA, authorized by 42 U.S.C. § 6921(b)(3)(C) and set forth in 40 C.F.R. § 261.4(b)(7)(ii)(P) and LAC 33:V105.D.2.h.xvi.

A typical analysis of process transport water is as follows:

Process Water	
Parameter	Concentration
pH	0.68 S.U.
Sp.G.	1.059
P_2O_5	2.65
F %	2.39
SO_4 %	2.56
Ca %	0.16
Fe (ppm)	500
Al (ppm)	2500
Mn (ppm)	32
Mg (ppm)	426
Na (ppm)	2500
K (ppm)	500

Related Waste

Related waste from the manufacture of phosphoric acid includes materials related to the process that are typically contaminated with the same constituents (gypsum, phosphoric acid, and low level radioactivity) that are deposited in approved, designated areas of the facility, such as contaminated filter cloths, rubber lining material, sludge, piping, scale, fire brick, sandblasting waste, waste sulfur, ditch clean-out material, filter aid, cooling tower sludge, and contaminated wooden pallets and plastic sheeting.

A permit modification request dated January 25, 1990 and additional information related to the modification dated September 26, 1990 and December 6, 1990 was approved by the LDEQ on January 2, 1991. The modification involved a change in the composition of the waste stream entering the permitted gypsum stacking area. The modification contained information concerning the deposition of contaminated filter cloth, sandblasting waste, waste sulfur, ditch cleanout sludge, filter aid, and cooling tower sludge deposited in the gypsum piles. The LDEQ recommended that the waste streams be placed in a designated area of the gypsum stacks. The waste streams that are deposited in a designated area of the gypsum stacks are permitted waste streams and are consistent with the January 2, 1991 approval. A copy of the approval is included in **Appendix C**. The materials are segregated in a disposal pit on top of stack #7 (See **Appendix B, Figure 1**).

Filtration Stream

Pursuant to a business arrangement with the neighboring Innophos facility, phosphoric acid, known as "green acid," produced by PCS Nitrogen is piped to Innophos. From this acid, Innophos produces a refined food grade, phosphoric acid product commonly referred to as "white acid." Innophos returns to the PCS Nitrogen facility via pipeline two side streams produced in connection with Innophos' white acid production operations. One side is referred to as "raffinate."

Raffinate is used directly in PCS Nitrogen's production processes and will be discussed in more detail below. The second side steam produced by Innophos and returned to PCS Nitrogen is referred to as the "filtration stream." The filtration stream is produced as a result of Innophos's initial filtering step when the green acid (supplied by PCS Nitrogen) is filtered to remove principally fluoride.

As detailed below, fluoride occurs naturally in PCS Nitrogen's feed stock phosphate rock. Innophos' filters are washed with process water supplied by PCS Nitrogen. The filtration stream, which contains both a liquid fraction (process water) and a solid fraction (filter cake), is returned to the PCS Nitrogen facility via pipeline. At the PCS Nitrogen facility, the filtration stream is piped first to a dedicated storage tank on PCS Nitrogen property and then to the gyp pump tank. From the gyp pump tank, the filtration stream is transported to the gypsum facility. At the gypsum facility, solids (gypsum, precoat) settle out and the liquid fraction is returned to the PCS Nitrogen phosphoric acid process for reuse. The solid and liquid fractions of the filtration stream are exempt from hazardous waste regulation because each is Bevill-exempt. The solids washed from the filters constitute "phosphogypsum", and the water used to wash the filters and transport the solids constitutes "process wastewater from phosphoric acid production" as those terms are used in the Bevill exclusion. 42 U.S.C. §6921(b)(3)(C), 40 C.F.R. §261.4(b)(7)(ii)(D) and (P) and LAC 33:V.105.D.2.h.iv and xvi.

Information concerning the volume and constituents of the filtration stream are summarized below.

Composition and Rate of the Filtration Stream
(As Returned to PCS Nitrogen)

	Lb./ Hr.	Percent*
Calcium Sulfate	188.35	3.0181
Precoat	18.30	0.2932
Fluoride	93.08	1.4916
Phosphoric Acid (H3PO4)	219.75	3.5214
Sodium	11.13	0.1784
Sulfur Colloidal	1.19	0.0191
Arsenic	0.37	0.0059
Copper	0.35	0.0056
Molybdenum	0.14	0.0022
Water	5706.97	91.4510
Total	6240.47	100.00

*Without regard to significant figures.

RAW MATERIALS AND PROCESS

The raw materials used to manufacture phosphoric acid are the principal source of waste disposed at the facility. The raw materials used to manufacture phosphoric acid (and gypsum) are phosphate rock, sulfuric acid purchased and produced on-site from molten sulfur, and a by-product stream (raffinate) from the neighboring Innophos process.

Manufacturing Process

Phosphoric acid is manufactured by reacting phosphate rock and sulfuric acid to produce a slurry of calcium sulfate hemihydrate ("hemi") and phosphoric acid, which is separated by filtration. After separation from the phosphoric acid, the hemi is hydrated to gypsum in a transformation tank in the presence of process water to which sulfuric acid is added to promote the hydration.

The separation of hemi and phosphoric acid is never 100% efficient, and the hemi leaving the filter contains some residual phosphoric acid that: (a) is not removed; (b) is in the process water used to wash and displace the acid from the hemi; and (c) remains in the hemi as it leaves the filter. It also contains some dicalcium phosphate incorporated into the body of the hemi crystal in a solid solution, and it contains some unreacted phosphate rock. In addition, sand, clay, precipitated metal species and fluoride species from the phosphate rock are included in the hemi and in the gypsum. This particular set of impurities is characteristic of gypsum generated by the manufacture of phosphoric acid and explains why such gypsum is distinguished by the name *phosphogypsum.*

Raw Materials

Phosphate Rock

Phosphate rock is principally calcium phosphate and calcium fluoride (almost 4% expressed as F) with iron and aluminum in the low percent ranges and other metals in the parts-per-million range. Phosphate rock also contains small percentages each of sand and clay. All of these non-phosphate impurities in the phosphate rock ultimately are distributed among the product acid, the process water, and the solid gypsum. The following is a typical analysis of the phosphate rock:

Moroccan Boucraa Mine

Phosphorus %	15.76
Fluoride %	3.92
Antimony, ppm	67
Arsenic, ppm	11.3
Beryllium, ppm	3.1
Cadmium, ppm	39.8
Chromium, ppm	115
Copper, ppm	15
Lead, ppm	55
Mercury, ppm	0.043
Nickel, ppm	1.03
Selenium, ppm	0.6
Silver, ppm	3.0
Thallium, ppm	42.3
Zinc, ppm	69
Aluminum, ppm	4336 Al_2O_3
Uranium, ppm	73
Gross Alpha pCi/g	174
Radium – 226 pCi/g	23.5

Process Water

Process water is water used in the manufacture of phosphoric acid that has become contaminated with phosphoric acid and related impurities. Since the phosphoric acid process is a net consumer of water, water must constantly be added to the system. The process is designed to utilize process water on the filter to recover the phosphate and sulfate values the filter contains.

Process water serves many functions, but all process water is part of one system, *i.e.*, there is one type of process water. Although it may have differing characteristics temporarily in a local use, it is all commingled eventually. It is called either *process water* or *active water*.

Process water is used for the following:

- Used as a scrubbing medium to scrub exit gases in scrubbers to capture fluoride vapors. The scrubbing increases the fluoride and phosphate content of process water

- Used as cooling water in evaporators that concentrate phosphoric acid. This use increases the fluorides and phosphate content of the process water

- Used to wash the filter cloths after the hemi is released from the filter and to re-pulp the discharged hemi to transfer it to the transformation tank. When used in this way, the process water collects phosphoric acid and other impurities inherent to phosphoric acid

- Used to transport the gypsum from the transformation tank via pipeline as a slurry to the gypsum stacking areas. When used in this way, the process water becomes intimately mixed with the gypsum and can pick up all the soluble species associated with the gypsum. The process water picks up sulfuric acid used in the transformation tank to promote the hydration of hemi to dihydrate gypsum. When raffinate is used as the source of sulfuric acid in the transformation tank, the process water may also pick up the species contained in the raffinate

Raffinate Stream

Pursuant to a business arrangement with Innophos, phosphoric acid produced by PCS Nitrogen (known as "green acid") is piped to Innophos. From this acid, Innophos produces a refined, food grade, phosphoric acid product commonly referred to as "white acid." Innophos returns to PCS Nitrogen via pipeline two side streams produced in connection with Innophos' white acid production operations. One side stream, the filtration steam, is discussed above. The second side stream is referred to as "raffinate" or the "raffinate stream."

The raffinate stream is produced using a solvent extraction process during the filtering step when the filtered green acid is processed further to remove the remaining fluoride values and other impurities naturally occurring in the feedstock phosphate rock.

Innophos removes the fluoride, kerosene and tributyl phosphate ("TBP"). The raffinate stream is generated as a result of this extraction process. The raffinate stream is returned to PCS Nitrogen via pipeline. At PCS Nitrogen, the facility uses the raffinate stream in lieu of or in addition to commercial grade sulfuric acid in the transformation tanks to transform hemi hydrate gypsum into pumpable dihydrate gypsum. The raffinate as reused by PCS Nitrogen is not a solid waste. Rather, the raffinate stream is a secondary material that is reused without reclamation. Reuse of a secondary material (in this case a by-product) as an effective substitute for a commercial product (in this case sulfuric acid) exempts the material from solid waste status per 40 C.F.R. §261.2(e)(ii) (see also 40 C.F.R. §261.1(c)(5)(ii)). PCS Nitrogen's reuse of the by-product raffinate stream in the transformation tanks was authorized by the LDEQ in a permit modification approval dated January 2, 1991.

Information concerning the volume and constituents of the raffinate stream are summarized below.

Composition and Rate of the Raffinate Stream
(As Returned to PCS Nitrogen)

	Typical (Average 2001) lb/Hr
Phosphoric Acid	1270
Sulfuric Acid	2400
Sodium	730
Iron	148
Aluminum	111
Magnesium	56
Fluoride	148
Tributyl Phosphate	0.17
Kerosene	0.17
Organic Carbon	1.34
Water	28,535
Total	33,400

Composition and Rate of the Raffinate Stream
(As Returned to PCS Nitrogen)

	Low End		High End	
	lb/Hr	Percent*	lb/Hr	Percent*
Phosphoric Acid	1270	3.8024	3300	9.0659
Sulfuric Acid	2400	7.1856	7300	20.0549
Sodium	730	2.1856	910	2.5000
Iron	148	0.4431	148	0.4066
Aluminum	111	0.3323	111	0.3049
Magnesium	56	0.1677	56	0.1538
Fluoride	148	0.4431	148	0.4066
Tributyl Phosphate	0.17	0.0005	0.73	0.0020
Kerosene	0.17	0.0005	0.73	0.0020
Organic Carbon	1.34	0.0040	3.28	0.0090
Water	28.535	85.4341	24.422	67.0934
Total	33,400	100.00	36,400	100

*Without regard to significant figures.

b. **waste-handling procedures from entry to final disposition, which could include shipment of recovered materials to a user;**

No waste is received from off-site. The gypsum is delivered by pipeline as a slurry from the phosphoric acid plant approximately two miles south of the facility. At the facility, the solid gypsum settles out in the facility and the process water utilized to transport the solid waste is collected in the Active Clearwell. From the Active Clearwell, the transport water is returned by pipeline to the phosphoric acid plant for reuse.

c. **minimum equipment to be furnished at the facility;**

The minimum equipment furnished at the facility (not including pumps) - a track hoe, a bulldozer, and a cat track hoe. A number of pumps of various kinds and sizes also are required.

d. **plan to segregate wastes, if applicable;**

All wastes received by the gypsum facility are compatible. The contaminated filter cloths and other related wastes are deposited in designated areas in the gypsum stacking area so that their locations will be known if it ever becomes possible to recover the gypsum for beneficial re-use.

e. **procedures planned in case of breakdowns, inclement weather, and other abnormal conditions (including detailed plans for wet-weather access and operations);**

The PCS Nitrogen Environmental Department will be notified of all conditions at the plant that could have an adverse effect on the environment, whether this condition involves the disposal and/or treatment of waste or the operation of the plant. The Environmental Department will notify the appropriate agencies and company officials, and take the necessary action to resolve the problem and to protect the environment. The following plans are available at the plant and can be activated in emergency or abnormal situations:

- Emergency Management Plan for the Geismar Facility (includes Crisis Communication)
- Solid Waste Contingency Plan for the Phosphogypsum Facility

- Spill Prevention Control and Countermeasure (SPCC) Plans for Chemical Spill and Oil Pollution Prevention

These plans will be updated/replaced as necessary to meet the needs of the facility and the applicable requirements that govern the PCS Nitrogen plant.

Additionally, the facility's roads are constructed, routed, and maintained to provide ongoing wet weather access to all pumps, electrical infrastructure, stack areas, ditches, and ponds during wet weather events.

f. **procedures, equipment, and contingency plans for protecting employees and the general public from accidents, fires, explosions, etc., and provisions for emergency care should an accident occur (including proximity to a hospital, fire and emergency services, and training programs); and**

The plans listed in Section H.1.e are available in case of emergency. These plans give the details of the procedure to be followed and the equipment available at the plant.

PCS Nitrogen has emergency procedures to handle any emergency should one arise. The site has comprehensive emergency response plans and training plans that are reviewed annually and updated as needed. Employees are trained in the particulars of these plans annually. As noted in 521.H.1.e, the following plans are available at the plant and can be activated in emergency or abnormal situations:

- Emergency Management Plan for the Geismar Facility (includes Crisis Communication)
- Solid Waste Contingency Plan for the Phosphogypsum Facility
- SPCC Plans for Chemical Spill and Oil Pollution Prevention.

These plans will be updated/replaced as necessary to meet the needs of the facility and the applicable requirements that govern the PCS Nitrogen Plant.

Personnel are required to follow all plant safety rules and regulations. These rules and regulations cover all aspects of operating and maintaining a chemical plant. Operations personnel are required to attend monthly safety meetings. Because the gypsum facility poses no fire or explosion threat, it is not necessary to make formal arrangements with local fire and police departments. Nevertheless, fire protection is provided by a fire department, which is jointly managed by Honeywell, Williams, and PCS Nitrogen. Plant personnel provide first aid, and Honeywell is capable of providing ambulance service. A letter from PCS Nitrogen certifying that the facility can respond to and manage fire emergencies is included in **Appendix C**.

PCS Nitrogen's Training Plan is included in **Appendix U**. The training plan consists of training for supervisors and operators directly involved in the operations and/or management of the gypsum facility. Initially, they will be trained on the contingency plan and operation of the facility. They will receive retraining consisting of the same information, at least annually.

St. Elizabeth's Hospital in Gonzales is approximately six miles from the plant. The hospital is equipped to handle emergency situations should they occur. A letter of certification from St. Elizabeth's Hospital is included in **Appendix C**. A letter from the Acadian Ambulance Service is also included in **Appendix C**.

g. **provisions for controlling vectors, dust, litter, and odors.**

None of the wastes delivered to the facility will attract or harbor vectors, nor will the waste contain or generate litter. Dust is not a problem because the gypsum is delivered as a slurry. The dried gypsum forms a hard cake on the surface and is ordinarily not dusty. In addition, vehicular traffic is kept to a minimum.

2. **The following information on operational plans is required for Type I and II facilities:**

a. **a comprehensive operational plan describing the total operation, including (but not limited to) inspection of incoming waste to ensure that only permitted wastes are accepted (Type II landfills must provide a plan for random inspection of incoming waste loads to ensure that hazardous wastes or regulated PCB wastes are not disposed of in the facility.); traffic control; support facilities; equipment operation; personnel involvement; and day-to-day activities. A quality- assurance/quality-control [QA/QC] plan shall be provided for facilities receiving industrial waste; domestic-sewage sludge; incinerator ash; friable asbestos; non-hazardous petroleum- contaminated media; and debris generated**

from underground storage tanks [UST], corrective action, or other special wastes as determined by the administrative authority. The QA/QC plan shall include (but shall not be limited to) the necessary methodologies; analytical personnel; pre-acceptance and delivery restrictions; and appropriate responsibilities of the generator, transporter, processor, and disposer. The QA/QC plan shall ensure that only permitted, nonhazardous wastes are accepted;

The facility is designed to store gypsum in large stacks. Decisions concerning stacking locations, areas, and authorized rate-of-rise have been made based on the recommendations of PCS Nitrogen's geotechnical consultants.

Gypsum is delivered to the facility by pipeline as a gypsum/process water slurry. The gypsum slurry is deposited in a prepared receiving area where there are small dikes constructed of gypsum to direct the discharged gypsum slurry into the right channels so that the gypsum settles out and the water decants into the Active Clearwell. As the height increases, dikes and channels are modified to maintain a level rise throughout the current stacking area.

The ditches, pumps, pipelines, levees, and pond levels are checked visually several times a day.

The Maintenance Department is available for equipment repair and preventive maintenance. The quality of the gypsum slurry received at the facility is very consistent, because it travels via pipeline directly from a process vessel. In addition, the characteristics of the gypsum are well known.

Hazardous waste is not an issue. Under both Louisiana Law (LAC 33:V.105.D.17.d and p) and Federal Law [40 CFR 261.4(b)(7)(D) and (P)] neither phosphogypsum nor process wastewaters from phosphoric acid production are regulated as a hazardous waste. In addition, friable asbestos is not disposed at the facility, and open burning does not take place.

A detailed Operational Plan is included in **Appendix F**.

A certification report shall be sent to the LDEQ for approval prior to the placement of waste in newly constructed areas, in accordance with LAC 33:VII.509.

b. **salvaging procedures and control, if applicable; and**

Salvaging procedures have not yet been developed pending identification of a beneficial use for the gypsum. In the past, in anticipation of reuse, the gypsum stacks were allowed to "weather" in order to produce more valuable gypsum. Now, however, a grass cover is being installed.

Non-gypsum wastes are placed in designated areas so as not to interfere with future reuse that may be undertaken.

c. **scavenging control.**

The perimeter area is fenced. Unauthorized personnel and security personnel are not allowed to enter. Security personnel visit the facility on a daily basis. Scavenging is not a problem at the facility.

3. **The following information on operational plans is required for Type I and II landfarms:**

a. **items to be submitted regardless of land use:**

i. **a detailed analysis of waste, including (but not limited to) pH, phosphorus, nitrogen, potassium, *sodium, calcium, magnesium, sodium-adsorption* ratio, and total metals (as listed in LAC 33:VII.715.D.3.b);**

ii. **soil classification, cation-exchange capacity, organic matter, content in soil, soil pH, nitrogen, phosphorus, metals (as listed in LAC 33:VII.715.D.3.b), salts, sodium, calcium, magnesium, sodium-adsorption ratio, and PCB concentrations of the treatment zone;**

iii. **annual application rate (dry tons per acre) and weekly hydraulic loading (inches per acre); and**

iv. **an evaluation of the potential for nitrogen to enter the groundwater.**

Not applicable.

b. ***items to be submitted in order for landfarms to be used* for food-chain cropland:**

i. **a description of the pathogen-reduction method for septage, domestic sewage sludges, and other sludges subject to pathogen production;**

ii. **crops to be grown and the dates for planting;**

iii. **PCB concentration in waste;**

iv. **annual application rates of cadmium and PCBs; and**

v. **cumulative applications of cadmium and PCBs;**

Not applicable.

c. **items to be submitted for landfarms to be used for nonfoodchain purposes:**

i. **description of the pathogen-reduction method in septage, domestic sewage sludges, and other sludges subject to pathogen production; and**

ii. **description of control of public and livestock access.**

Not applicable.

4. **The following information on operational plans is required for Type I-A and II-A incinerator waste-handling facilities and refuse-derived energy facilities:**

a. **a description of the method used to handle process waters and other water discharges which are subject to NPDES permit and state water discharge permit requirements and regulations; and**

b. **a plan for the disposal and periodic testing of ash (all ash and residue must be disposed of in a permitted facility).**

Not applicable. PCS Nitrogen does not incinerate waste onsite.

5. **The following information on operational plans is required for Type I-A and II-A refuse-derived fuel facilities and Type III separation and composting facilities:**

a. **a description of the testing to be performed on the fuel or compost, and**

b. a description of the uses for and the types of fuel/compost to be produced.

Not applicable. PCS Nitrogen is not a refuse-derived fuel facility.

6. The operational plans for Type I-A and II-A refuse-derived fuel facilities and Type III separation and composting facilities must include a description of marketing procedures and control.

Not applicable. PCS Nitrogen is not a refuse-derived fuel facility.

7. The operational plans for Type I and II facilities receiving waste with a potential to produce gases must include a comprehensive air monitoring plan.

The facility does not have the potential to produce gas.

I. Implementation Plans. Standards governing implementation plans are contained in LAC 33:VII.709.D (Type I and II facilities), LAC 33:VII.717.H (Type I-A and II-A facilities), and LAC 33:VII.719.E (Type III facilities).

1. The implementation plans for all facilities must include the following:

a. a construction schedule for existing facilities which shall include beginning and ending time-frames and time-frames for the installation of all major features such as monitoring wells and liners. (Time-frames must be specified in days, with day one being the date of standard permit issuance); and

PCS Nitrogen is currently stacking in Phase 10 of the facility (See **Appendix B, Figure 1**). Refer to LAC 33:VII.521.I.1.b for a description of the phases of the landfill and their respective life spans. Within 90 days after construction of the additional monitor wells, PCS Nitrogen will submit to the Office of Environmental Services, Permits Division well-completion details to verify that the wells were constructed according to the approved specifications, and to document construction procedures. See **Table 6** for the Implementation Schedule.

Phased construction, and other activities required to provide proper operation of the facility and to provide adequate disposal areas, will continue throughout the life of the facility. When Stack 8 reaches the end of its useful life in approximately 2021, additional stacking areas will be developed either at the facility or in a new gypsum facility.

The stages of the current gypsum-stacking plan are shown on the series of drawings located in **Appendix B (Figure 3 - Figure 8)**. Implementation of the plan will require phased construction. The major aspects of the phases will be in the schedule and likely will involve changing locations for the placement of gypsum. Routine operational and maintenance activities also will be undertaken.

Volume I

After the installation of the proposed monitoring wells, the isometric profile and groundwater sampling and analysis plan will be modified to incorporate the new wells.

Original Gypsum Stacking Plan

Formerly it was the practice at the facility to design a gypsum stacking area in the form of a single stack, and when a stack reached a certain height to inactivate it and construct a new stack. This practice required very little long-term planning. Indeed, the application for construction of Stack 8 was made on that basis when it appeared that the west unit (Stacks 1 through 7B) would reach capacity by 1994.

Current Gypsum Stacking Plan

The current gypsum stacking plan accomplishes two principal objectives: (1) to delay for as long as possible the need to construct a new stacking facility by converting the existing stacking area into one common stack; and (2) to improve the quality of water discharged to surface waters of the state (the Mississippi River). The current stacking plan makes better use of the existing gypsum stacking areas and will accommodate the gypsum produced at the plant until approximately 2015. As such, the useful life of the existing facility is extended, and the construction of Stack 8 is deferred.

Conversion to a Common Stack

Converting to a common stack has increased (or will increase) storage capacity by: (1) utilizing areas between stacks; (2) utilizing areas that currently are clearwells; and (3) stacking the gypsum to greater heights through the use of HDPE liner technology. The modified stacking plan has resulted in delaying construction of Stack 8 and minimizing rainfall collection areas.

The method for depositing gypsum has and will remain unchanged. The only change is where the gypsum will be directed. As stated above, the Active and Inactive Clearwells ultimately will be relocated. The usual stack instrumentation, such as inclinometers, piezometers, and observation wells, will be installed as required.

Elements of Gypsum Stacking Plan

The gypsum stacking plan will be implemented over the life of the facility. The plan includes several elements that are not essential to the storage of gypsum, but nevertheless are necessary to operate the facility in an environmentally sound manner:

- Installation of a soil/grass cover on inactive and active portions of the facility
- Construction and operation, if necessary, of evaporation ponds on inactive portions of the stacks

- Segregation of waters of differing quality. Decant water from the gypsum slurry and leachate from active stacks (decant water and leachate are the two most contaminated types of waters) are collected and routed back to the process. The management of active and inactive water is governed by the terms of the LPDES permit.

b. details on phased implementation if any proposed facility is to be constructed in phases.

The implementation of the gypsum stacking plan and the following construction activities will be implemented over the life of the facility:

1) Installing stack instrumentation
2) Installing soil/grass cover
3) Developing evaporation ponds (if necessary)
4) Relocating the Active and Inactive Clearwells
5) Horizontal and vertical expansion of common stack
6) Constructing Stack 8

<u>Phases of the Gypsum Stacking Plan</u>

The gypsum-stacking plan will consist of the following phases of construction:

- In Phase 9 and 10, areas formerly identified as Stacks 3 and 7 will be converted into one common stack and identified as Stack 3/7. Stack 3/7 will be increased in elevation to 220 feet. The capacity of Phases 9 and 10 is approximately 12,000-16,000 acre-feet and will reach final capacity in approximately 2007.

- In Transition Phase 10-11, construction activities will include preparation for and the actual westward expansion of gypsum disposal in the areas currently identified as the Active Clearwell and the Auxiliary Active Clearwell. As a result of the westward expansion, the Inactive Clearwell will become the Active Clearwell and the Inactive Surge Area (known as the "Triangle Area") will become the Inactive Clearwell.

- In Phase 11, Stack 2/7 will be increased in elevation to 220 feet. The capacity of Phase 11 is approximately 20,000 acre-feet and will reach final capacity in approximately 2015.

- In Phase 12, PCS Nitrogen will stack in the east unit (Stack 8). Phase 12 will have a final elevation of 80 feet. The construction of Phase 12 (Stack 8) will begin in approximately 2014. The capacity of Phase 12 is approximately 14,000 acre-feet, and will reach final capacity in approximately 2021.

The main feature of the gypsum stacking plan is the gradual increase in height of several existing stacking (and some clearwells) areas after the existing individual stacks have been converted to one common stack of the same base area. The main activity associated with implementing this plan is the change in the designated stacking areas over time.

2. **The implementation plans for Type I and II facilities must include a plan for closing and upgrading existing operating areas if the application is for expansion of a facility or construction of a replacement facility.**

This renewal application addresses the existing gypsum stacking area and the expansion area (Stack 8).

When Stack 8 becomes operational (approximately 2015), the stacking areas of the west unit (Stacks 1 through 7B and Stacks 3/7 and 2/7) will be closed as described in Section J.1.a. The clearwells and associated ditches and pipes in the west unit in service at that time will remain in service for use with Stack 8. Complete closure of the west unit will not occur until the east unit has reached capacity.

J. **Facility Closure. Standards governing facility closure are contained in LAC 33:VII.711.E (Type I and II landfills), LAC 33:VII.713.E (Type I and II surface impoundments), LAC 33:VII.715.E (Type I and II landfarms), LAC 33:VII.717.I (Type I-A and II-A facilities), LAC 33:VII.721.D (construction and demolition debris and woodwaste landfills), LAC 33:VII.723.D (Type III composting facilities), and LAC 33:VII.725.D (Type III separation facilities)**

1. **The closure plan for all facilities must include the following:**

a. **the date of final closure;**

West Unit
It is projected that the gypsum stacking areas of the west unit will reach capacity in approximately 2015. When the west unit has reached the end of its useful life, closure activities will commence. The remaining clearwells and associated piping and ditches will be reassigned to the east unit, and will remain in service and will not be closed until the east unit reaches the end of its useful life, now projected to be approximately 2021. At that time, final closure for the remaining features of the west unit will commence.

East Unit
Definite plans for closure of the east unit are not available at this time. For the purposes of this application, January 1, 2021 is the approximate date of closure for the east unit.

b. **the method to be used and steps necessary for closing the facility; and**

In accordance with the regulations contained in LAC 33:VII.711.E, at least 90 days prior to closure of the west unit and east unit, PCS Nitrogen will give written notice to the LDEQ regarding its intent to close the units. The notice will include the following information:

1) Date of planned closure
2) Changes, if any, requested in the approved closure plan
3) Closure schedule and estimated cost
4) Certification that closure is to be performed in accordance with the plan included in the permit application and approved by LDEQ

A request for the release of the closure fund will not be necessary since PCS Nitrogen is self-insured.

Closure Procedures (East and West Units)
PCS Nitrogen's plan for closure of the east and west units is to dome the top of the gypsum stacks by sloping all sides to provide maximum drainage. All surfaces will be covered with clay and a solid growth of Bermuda grass will be established. Any remaining leachate in the stacks at closure will be treated discharged through the LPDES outfall(s).

The current program of sloping the sides and covering with clay, soil, and grass cover as the stack is raised will limit the amount of leachate generated as a direct result of rainfall on the slopes of the stack. Therefore, it is estimated that no more than 10 acres of flat surface will remain to be domed and covered at closure. Two feet of clay will be spread in 6- to 9-inch layers to allow compaction to a permeability of 10^{-8} cm/sec (minimum) and sloped 4% to aid in drainage. After a closure inspection and approval, a 6-inch layer of topsoil and a seeded grass cover (Bermuda grass) will be established.

Final cover installation will be initiated no later than 30 days after, and shall be completed no later than 90 days after, final grades are reached in each unit of a facility, or the date of the final receipt of solid waste in the unit, whichever comes first. In accordance with LAC 33:VII.711.E.2.a, PCS Nitrogen acknowledges that the administrative authority may extend the deadlines, if necessary, due to inclement weather or other circumstances up to a maximum of 60 days for initiation, and a maximum of 180 days for completion.

Standing water will be solidified or removed.

The Active Clearwell and Inactive Clearwell in service when the west unit reaches capacity will be retained in service for use with the east unit.

Ditches surrounding the stacks also will remain in service for collection of rain run-off and for collection of leachate after Stack 8 is closed.

The run-off diversion system will be maintained and modified to prevent overflow of the units to adjoining areas.

- Closure of the Phase 10 stack area will involve installing a toe drain system to maintain the paretic surface below the slope cover, crowning the top of the stack to promote run-off and covering the top and sides with 24 inches of clay, 6 inches of topsoil, and a grass cover.

- Closure of the Stack 7 top area will involve lining the top of Stack 7 with a 40-mil HDPE liner, and covering the liner with 12 inches of clay, 6 inches of topsoil, and a grass cover.

- Closure of the Inactive Clearwell will involve pushing in the perimeter dikes, and covering the Inactive Clearwell and adjacent Triangle Area (Inactive Surge Basin) with 24 inches of clay, 6 inches of topsoil ,and a grass cover. This area will serve as a retention area for storm water before it is released off site. Any remaining inactive water will be discharged in accordance with LPDES permits.

- The Active Clearwell will remain as a holding pond for leachate water collection and storage prior to treatment and discharge. Toe drains will be installed along the west dike and east dike to supplement the existing toe drain on the north side of the Active Clearwell.

- Closure of the Auxiliary Active Clearwell will involve extending the leachate collection drain and toe ditch along the south side of Stack 7 and west toe ditch of the Phase 10 stack area, pushing in the west dike, grading the bottom area, and covering the bottom and slopes with 24 inches of clay, 6 inches of topsoil, and a grass cover. It is assumed that the Auxiliary Active Clearwell will not contain water upon closure.

- Upon closure, the surrounding ditches will be drained and the water will be discharged in accordance with LPDES permits. Upon completion of draining, non-perforated drain pipes will be installed in the ditches. The drain pipes already installed in the stacks will be connected to the ditch pipe and routed to the existing ditch pump station for discharge through the LPDES outfall(s) as treated active water. Finally, the enclosing levees will be pushed into the ditches and covered with 24 inches of clay compacted to achieve a permeability of 10^{-8} cm/sec (minimum). The clay cover will be sloped 4% to aid in drainage and then covered with 6 inches of topsoil. Finally, the cover will be seeded with Bermuda grass, which is native to this area of Louisiana and requires little or no maintenance.

- Closure of the Storm Water collection ponds will involve pushing in the perimeter dikes and covering the ponds with 24 inches of clay and a grass cover.

- Closure of the Lined Pond 2D will involve pushing down the perimeter dikes and covering the existing HDPE liner with 12 inches of clay, 6 inches of topsoil, and a grass cover.

c. **the estimated cost of closure of the facility, based on the cost of hiring a third party to close the facility at the point in the facility's operating life when the extent and manner of its operation would make closure the most expensive.**

The closure cost estimates for the west unit and the east unit are included in **Appendix V**.

2. **The closure plan for Type I and II landfills and surface impoundments must include:**

a. **description of the final cover and the methods and procedures used to install the cover;**

The final cover will be soil from the levees and suitable clay acquired elsewhere. The clay will be spread a minimum of 24 inches and compacted to achieve a permeability of 10^{-8} cm/sec (minimum). The area will be sloped (from the center) a minimum of four percent to provide adequate drainage.

Topsoil will be spread over the clay cover to a depth of six inches and seeded with Bermuda grass.

Third party consultants shall be retained to supervise closure, to certify that construction has been completed in accordance with procedures herewith, and to ensure that quality control procedures are followed.

b. **an estimate of the largest area of the facility ever requiring a final cover at any time during the active life;**

A soil/grass cover has been installed on inactivated parts of the stacks and on the lower parts of active stacks in the west unit. Therefore, when final closure activities begin, all but approximately ten (10) acres of the disposal facility will be closed.

Phase 10 will be the largest area that will require final cover at one time during the active life of the west unit. A soil/grass cover has been installed on inactivated parts of the stacks and on the lower parts of the active stacks in the west unit. The east unit consists of 125 acres. See **Appendix B** drawings.

c. **an estimate of the maximum inventory of solid waste ever on-site over the active life of the facility; and;**

Volume of West Unit at Closure (Stacks 1-7, 3/7, 2/7)

Basis
All stacks will be raised to their maximum heights with varying 1:6 ~ 1:3 ratio side slopes. The maximum heights raised will range from 90 feet on stacks 7/AB to 220 feet on stacks 3/7 and 2/7.

Volume
Approximately 68 million cu. yds. (As calculated by Auto Cad).

Volume of East Unit at Closure (Stack 8)
Basis
125 Ac. x 60 ft. high with 3 horizontal to 1 vertical side slopes

Dimensions
125 acres (footprint); 4-acre top portion

Volume
(125 + 4) / 2 X 43560 X 60
= 1.68×10^6 cu. ft. or 6.2×10^6 cu. yd.

d. **a schedule for completing all activities necessary for closure.**

The following is an estimate of time associated with completing all activities necessary for closure:

Closure Activity	Duration
Phase 10 Stack Area Grading and Contouring Placement of Cover & Toe Drain Installation Grassing Slopes & Storm Water Control System	8 – 12 months
Closure of Stack 7 Top Area Grading, Contouring, Compacting Liner Installation Placement of Clay/Soil Cover, Grassing	6 – 8 months
Storm Water Collection Ponds (2) Grading and Contouring Placement of Clay/Soil Cover, Grassing	3 – 6 months
Lined Pond 2D (Stack 3 West) Grading and Contouring Placement Clay/Soil Cover, Grassing	2 – 3 months
Auxiliary Active Clearwell Grading and Contouring Placement of Clay/Soil Cover, Grassing (Flat Areas & Slopes)	3 – 6 months
Inactive Clearwell Grading and Contouring Placement of Clay/Soil Cover, Grassing	3 – 6 months
Active Clearwell Toe Drain Installation	2 – 3 months
Stack 8 Grading and Contouring Placement of Cover, Grassing	3 months

3. **The closure plan for all Type I and II facilities and Type III woodwaste and construction/demolition debris facilities shall include the following:**

   a. **the sequence of final closure of each unit of the facility, as applicable;**

   The gypsum stacking areas of the west unit will be closed first. This does not include the clearwells and associated piping and ditches. Afterwards, the east unit will be closed, and at that time the remaining features of the west unit also will be closed.

   Overall Closure Procedures (East and West Units)
   PCS Nitrogen's plan for closure of the east and west units is to dome the top of the gypsum stacks by sloping all sides to provide maximum drainage. All surfaces will be covered with clay, and a solid growth of Bermuda grass will be established. Any remaining leachate in the stacks at closure will be treated and discharged through the LPDES outfall(s).

   The current program of sloping the sides and covering with clay, soil, and grass cover as the stack is raised will limit the amount of leachate generated as a direct result of rainfall on the slopes of the stack. Therefore, it is estimated that no more than 10 acres of flat surface will remain to be domed and covered at closure. Two feet of clay will be spread in 6- to 9-inch layers to allow compaction to a permeability of 10^{-8} cm/sec (minimum) and sloped 4% to aid in drainage. After a closure inspection and approval, a 6-inch layer of topsoil and a seeded grass cover (Bermuda grass) will be established.

   Final cover installation will be initiated no later than 30 days after, and shall be completed no later than 90 days after, final grades are reached in each unit of a facility, or the date of the final receipt of solid waste in the unit, whichever comes first. In accordance with LAC 33:VII.711.E.2.a, PCS Nitrogen acknowledges that the administrative authority may extend the deadlines, if necessary, due to inclement weather, or other circumstances up to a maximum of 60 days for initiation and a maximum of 180 days for completion.

   Standing water will be solidified or removed.

   The Active Clearwell and Inactive Clearwell in service when the west unit reaches capacity will be retained in service for use with the east unit.

Ditches surrounding the stacks also will remain in service for collection of rain run-off and for collection of leachate after Stack 8 is closed.

The run-off diversion system will be maintained and modified to prevent overflow of the units to adjoining areas.

Sequence of Final Closure

- Closure of the Phase 10 stack area will involve installing a toe drain system to maintain the paretic surface below the slope cover, crowning the top of the stack to promote run-off and covering the top and sides with 24 inches of clay, 6 inches of topsoil, and a grass cover.

- Closure of the Stack 7 top area will involve lining the top of Stack 7 with a 40-mil HDPE liner, and covering the liner with 12 inches of clay, 6 inches of topsoil, and a grass cover.

- Closure of the Inactive Clearwell will involve pushing in the perimeter dikes, and covering the Inactive Clearwell and adjacent Triangle Area (Inactive Surge Basin) with 24 inches of clay, 6 inches of topsoil, and a grass cover. This area will serve as a retention area for storm water before it is released off site. Any remaining inactive water will be discharged in accordance with LPDES permits.

- The Active Clearwell will remain as a holding pond for leachate water collection and storage prior to treatment and discharge. Toe drains will be installed along the west dike and east dike to supplement the existing toe drain on the north side of the Active Clearwell.

- Closure of the Auxiliary Active Clearwell will involve extending the leachate collection drain and toe ditch along the south side of Stack 7 and west toe ditch of the Phase 10 stack area, pushing in the west dike, grading the bottom area, and covering the bottom and slopes with 24 inches of clay, 6 inches of topsoil, and a grass cover. It is assumed that the Auxiliary Active Clearwell will not contain water upon closure.

- Upon closure, the surrounding ditches will be drained and the water will be discharged in accordance with LPDES permits. Upon completion of draining, non-perforated drain pipes will be installed in the ditches. The drain pipes already installed in the stacks will be connected to the ditch pipe and routed to the existing ditch pump station for discharge through the LPDES *outfall(s) as treated active water.* Finally, the enclosing levees will be pushed into the ditches and covered with 24 inches of clay compacted to achieve a permeability of 10^{-8} cm/sec (minimum). The clay cover will be sloped 4% to aid in drainage, and then covered with 6 inches of topsoil. Finally, the cover will be seeded with Bermuda grass, which is native to this area of Louisiana and requires little or no maintenance.

- Closure of the Storm Water collection ponds will involve pushing in the perimeter dikes and covering the ponds with 24 inches of clay and a grass cover.

- Closure of the Lined Pond 2D will involve pushing down the perimeter dikes and covering the existing HDPE liner with 12 inches of clay, 6 inches of topsoil, and a grass cover.

The following sequence of final closure will be addressed specifically for Stack 8:

- Water from the Active Clearwell will be treated as allowed by the regulating agency. After treatment, water will be pumped or drained to the inactive clearwell for discharge per the LPDES permit.

- *Upon completion*, work *will begin simultaneously to* dome and cover the gypsum stack top and fill in the Inactive and Active Clearwells.

- Upon completion of covering with clay, topsoil will be spread over all three areas and seeded with Bermuda grass.

- Non-perforated drainpipes will be installed in the ditches. The drain pipes already installed in the stacks will be connected to the ditch pipe and routed to the existing ditch pump station for discharge through an LPDES outfall(s) as treated active water. Finally, the pipe and ditches will be covered with the clay levee around the ditches, compacted, and planted with Bermuda.

b. **a drawing showing final contours of the facility; and**

The final contours of the facility are shown in **Appendix B** (**Figure 6** and **Figure 8**).

c. **a copy of the document that will be filed upon closure of the facility with the official parish recordkeeper *indicating the location and use of the property for solid* waste disposal, unless the closure plan specifies a clean closure.**

The closure document is included in **Appendix W**.

K. **Facility Post-Closure. Standards governing post-closure requirements are contained in LAC 33:VII.711.F (Type I and II landfills), LAC 33:VII.713.F (Type I and II surface impoundments), LAC 33:VII.715.F (Type I and II landfarms), and LAC 33:VII.721.E (Type III construction and demolition debris and woodwaste landfills).**

1. **The post-closure plan for all facilities must include the following:**

   a. **specification of the long-term use of the facility after closure, as anticipated; and**

   PCS Nitrogen does not have any definite plans for the facility after closure.

   If a suitable use for the stored gypsum is developed, then PCS Nitrogen will recover the stored gypsum from the facility.

   b. **the cost of conducting post-closure of the facility, based on the estimated cost of hiring a third party to conduct post closure activities in accordance with the closure plan.**

   The post-closure cost estimate is included in **Appendix X**.

2. **The post-closure plan for Type I and II facilities must include the following:**

   a. **the method for conducting post-closure activities, including a description of the monitoring and maintenance activities and the frequency at which they will be performed;**

   PCS Nitrogen will monitor the inclinometers, maintain the integrity and effectiveness of the final cover (including making repairs to the cover as necessary to correct the effects of settling, subsidence, erosion, or other events), prevent run-on and run-off from eroding or otherwise damaging the final cover, and provide annual reports to the administrative authority on the integrity of the final cap.

   PCS Nitrogen will maintain the grass cover and patch or re-seed, as necessary.

   PCS Nitrogen will maintain the groundwater monitoring system and monitor the groundwater in accordance with LAC 33:VII.709.E. PCS Nitrogen will conduct semi-annual

5
2
1
K

groundwater sampling in accordance with the Sampling and Analysis Plan (**Appendix S**).

PCS Nitrogen will maintain and operate the leachate collection and removal system, until leachate is no longer generated, or until it is demonstrated that the leachate no longer poses concern in accordance with LAC 33:V.I.Chaper 13.

In accordance with LAC 33:VII.711.F.2.c, PCS Nitrogen acknowledges the 30-year post-closure care period. However, PCS Nitrogen reserves the right to request a decrease in the length of the post-closure care period if it is demonstrated that the reduced period is sufficient to protect human health and the environment in accordance with LAC 33:I.Chapter 13, and this demonstration is approved by the Department. The demonstration will provide supporting data, including adequate groundwater monitoring data.

b. **the method for abandonment of monitoring systems, leachate collection systems, gas-collection systems, etc.;**

Approval will be obtained from the Department prior to abandonment of the groundwater monitoring system. Upon approval, the monitoring wells will be removed, and plugged and abandoned in accordance with applicable regulations.

Upon final approval, the leachate drainpipes in each stack will be blocked off and the ditch pump will be replaced with a covered sump, which will be available for monitoring during the post-closure period. The facility does not have a gas-collection system.

c. **measures planned to ensure public safety, including access control and gas control; and**

The warning signs and fences will be maintained during the entire closure and post-closure period. Due to the characteristics of the waste handled, gas control is neither applicable nor necessary. Plant security and access control will be maintained for as long as the complex remains in operation.

d. **a description of the planned uses of the facility during the post-closure period.**

PCS Nitrogen does not have any definite plans for the facility after closure.

5
2
1
L

L. Financial Responsibility. Standards governing financial responsibility are contained in LAC 33:VII.727. A section documenting financial responsibility according to LAC 33:VII.727 which contains the following information, must be included for all facilities:

1. the name and address of the person who currently owns the land and the name and address of the person who will own the land if the standard permit is granted (if different from the permit holder, provide a copy of the lease or document which evidences the permit holder's authority to occupy the property); or

PCS Nitrogen Fertilizer, L.P.
Potash Corp.
Suite 500, 122
1st Avenue South
Saskatoon, Saskatchewan, Canada

2. the name of the agency or other public body that is requesting the standard permit; or, if the agency is a public corporation, its published annual report; or, if otherwise, the names of the principal owners, stockholders, general partners, or officers;

The published annual report of PCS Nitrogen is located in **Appendix Y**.

3. evidence of liability coverage, including:

A. personal injury, employees, and the public (coverage, carriers, and any exclusions or limitations);

Evidence of financial responsibility in included in **Appendix Y.**

B. property damage (coverage and carrier);

Evidence of financial responsibility is included in **Appendix Y**.

C. environmental risks; and

Evidence of financial responsibility is included in **Appendix Y**.

4. **evidence of a financial assurance mechanism for closure and/or post-closure care and corrective action for known releases when needed.**

   Evidence of financial responsibility is included in **Appendix Y**.

M. Special Requirements. The administrative authority may require additional information for special processes or systems and for supplementary environmental analysis.

This regulation is acknowledged by PCS Nitrogen.

5
2
1
m

PART III

ADDITIONAL SUPPLEMENTARY INFORMATION

PCS NITROGEN FERTILIZER, L.P.

LAC 33:VII.523
Part III: Additional Supplementary Information

PHOSPHOGYPSUM
STACKING FACILITY

PREPARED BY:

PROVIDENCE ENGINEERING AND
ENVIRONMENTAL GROUP, LLC
6160 PERKINS ROAD, SUITE 100
BATON ROUGE, LOUISIANA 70810
(225) 766-7400

LAC 33:VII.523
Part III: Additional Supplementary Information

The following supplementary information is required for all solid waste processing and disposal facilities. All responses and exhibits must be identified in the following sequence to facilitate the evaluation:

INTRODUCTION

Environmental permit applicants (both new and existing facilities) are required to provide relevant information in response to questions commonly referred to as "IT Questions", which address the potential for facilities to adversely impact the human and natural environment in the vicinity of the proposed or existing facility. These responses must be considered by the LDEQ during the decision–making process on environmental permits pursuant to the Louisiana Supreme decision in the case of Save Ourselves, Inc. vs. Louisiana Control Commission. While this ruling was designed to address impacts associated with new facilities, existing facilities must consider the impact of continued operation versus the impacts of constructing a new facility at different locations.

PCS Nitrogen Fertilizer L.P. (PCS) was granted a permit for the solid waste gypsum stacking facility in Geismar, Louisiana. Since the issuance of the permit, PCS has demonstrated a record of environmental compliance and continues to provide economic benefits to the surrounding area. The following responses clearly demonstrate that the potential adverse environmental impacts resulting from the continued operation of the PCS facility have been appropriately addressed and pale in comparison to the alternative of constructing a new facility for the disposal of phosphogypsum generated at the PCS plant at a separate location.

BACKGROUND

The existing gypsum (also known as "phosphogypsum" or "gyp") stacking facilities are located approximately four miles northwest of Geismar, Louisiana in the northeast quadrant of the intersection of Louisiana Highways 30 and 3115. It is bounded by Highway 74 on the north, Highway 30 on the south, and Highway 3115 and a gas pipeline right-of-way on the west. Major drainage is provided by the New River located east of the facility and by Bayou Braud located a half mile northwest of the facility. The Mississippi River is located south of the facility adjacent to the plant area of the complex. The existing stacking facility and the proposed expansion area consist of approximately 416 acres.

Approximately 1.1 million tons per year of gypsum are disposed of in the stacking facilities. Other non hazardous solid wastes generated as a result of the manufacture of phosphoric acid also are disposed in the stacking facility. These nonhazardous wastes include materials related to the manufacturing process which are typically contaminated with the same species (gypsum, phosphoric acid, low level radioactivity) that are deposited in the facility, such as contaminated filter cloths, rubber lining material, sludge, piping, scale, fire brick, sandblasting waste, waste sulfur, ditch cleanout material, filter aid, cooling tower sludge, contaminated wooden pallets and plastic sheeting. The facility will be used for the disposal of soils and sludges contaminated with phosphoric acid and sulfuric acid, contaminated sulfuric acid media including filters, ceramic saddles, sludges, ditch cleanout material, metals and the like. A contiguous perimeter levee exists and is maintained to prevent run-on and run-off of storm water from a 25-year, 24-hour storm event.

The gypsum that is deposited in the stacking facilities is produced in the phosphoric acid manufacturing plant located approximately two miles south of the stacking facility. Gypsum (also known chemically as calcium sulfate dihydrate) is produced as a result of the manufacture of phosphoric acid. Approximately 4.8 tons of gypsum (dry basis) are produced for every ton of phosphoric acid (P_2O_5) produced. Phosphoric acid is manufactured by reacting phosphate rock and sulfuric acid to produce a slurry of calcium sulfate hemihydrate ("hemi") and phosphoric acid, which is separated by filtration. After separation from the phosphoric acid, the hemi is hydrated to gypsum in a transformation tank in the presence of process water to which sulfuric acid is added to promote hydration. Phosphate rock is principally calcium phosphate and calcium fluoride (almost 4% expressed as F) with iron and aluminum in the low percent ranges and other metals in the parts-per-million range. Phosphate rock also contains small percentages each of sand and clay. All of these non-phosphate impurities in the phosphate rock ultimately are distributed among the product acid, the process water, and the solid gypsum.

The stacking facility has two units - the west unit and the east unit. The west unit consists of the gypsum stacking area which currently is in use and which has been in use since the 1960's. It was initially constructed utilizing individual stacking areas called stacks which were identified by number in order of their construction. Stack 1 is located in the southwest part of the west unit, and counter clockwise are Stacks 2, 3, 4, 5, 6, 7A, and 7B of the west unit. The east unit consists of Stack 8 and lies to the east of the Entergy right-of-way on the eastern edge of the west unit. The features and structures making up the gypsum stacking facilities include gypsum stacking areas, clearwells (working impoundments), evaporation ponds, roads, ditches, drainage pipes, pipelines for gypsum slurry and return water, pumps, and construction equipment such as trac hoes, bulldozers, front end loaders, etc.

PCS has implemented a new gypsum- stacking plan for the west unit. As a result, PCS now manages the individual stacks as one common stack. This has been accomplished by, among other things, depositing gypsum in the areas between the individual stacks. The new stacking plan has been implemented in phases. Phases 1 through 8 are completed, and PCS is currently stacking gypsum in Phase 10 of the gypsum- stacking plan.

Phases of the Gypsum Stacking Plan

- In Phase 9, the areas formerly identified as Stacks 3 and 7 have been converted into a common stack and identified as Stack 3/7 with a final elevation of 65 feet.
- In Phase 10, the Phase 9 area (Stack 3/7) will be increased in elevation to 220 feet. PCS Nitrogen is currently stacking in Phase 10. PCS Nitrogen plans to stack gypsum in Phase 10 until approximately 2007.
- In Transition Phase 10-11, construction activities will include preparation for and the actual westward expansion of gypsum disposal in the area currently identified as the Active Clearwell and the Auxiliary Active Clearwell. Construction activities will be completed in approximately 2006-2007. As a result of the westward expansion, the Inactive Clearwell will become the Active Clearwell and the Inactive Surge Area (known as the "Triangle Area") will become the Inactive Clearwell. The disposal of gypsum in the transition phase will occur until approximately 2008.
- In Phase 11, Stack 2/7 will be increased in elevation to a final elevation of 220 feet. PCS Nitrogen will begin stacking in Phase 11 in approximately 2008 and plans to stack gypsum in Phase 11 until approximately 2015.
- In Phase 12, PCS will stack in the east unit (Stack 8). Phase 12 will have a final elevation of 80 feet.

The west unit will remain in service for gypsum disposal until approximately 2015. The east unit of the facility is not currently part of the facility's operation and will not be part of the operation until approximately 2015. Construction of the east unit will not commence until approximately 2014.

Features and Structures

- Clearwells are working impoundments. The Inactive Clearwell is used to accumulate excess rainfall that falls on the inactive portions of the facility and other waters managed in the inactive water management system. Water from the Inactive Clearwell is either discharged to the Mississippi River in accordance with the terms and conditions of the LPDES Permit or is transferred to the Active Clearwell for use in the phosphoric acid production process. The Active Clearwell receives run-off water from the active stacking area and leachate from the active gypsum stacking facility and, to the extent feasible, from the inactive portions of the stacking facility. The Auxiliary Active Clearwell acts as a surge control area for the active stacking area. The waters from the Active Clearwell and the Auxiliary Active Clearwell are returned to the phosphoric acid process. The Inactive Surge Area serves as a surge control area for the inactive portions of the unit. As the gypsum stacking plan progresses, the location and function (active or inactive) of the clearwells will change in accordance with the stacking plan as represented in this permit renewal application.

- Storm Water Surge Ponds are located along the southeastern edge of the facility and collect run-off from capped, and grassed areas of the facility.
- Evaporation Ponds are temporary shallow ponds that may be used to reduce by evaporation the amount of water that must be managed in the facility. If used, evaporation ponds will be constructed in inactive stacking areas and the location of the evaporation ponds will change as the west unit matures.
- Ditches are used to manage water in the facility. Most of the ditches are perimeter ditches used to collect and transport rainfall run-off from the gypsum stacking areas to the appropriate clearwell.
- Surface run-off from the facility is collected in interceptor ditches and pumped to the Inactive Clearwell.
- Toe Drains (Inactive Clearwell) are located in a toe drain collection system surrounding the Inactive Clearwell. This water is pumped back into the Inactive Clearwell.
- Toe Drains (Interceptor Ditches) are constructed in association with the perimeter ditches and are located along the perimeter of the gypsum stacking facility. Leachate from this toe drain system is pumped to a sump and then to the Active Clearwell.
- The gypsum deposited in the facility is generated at the phosphoric acid manufacturing plant located in the southern portion of the complex about two miles away. The gypsum is transported in a slurry by pipeline (the gypsum line) to the gypsum stacking area. The slurry is discharged onto the active stacking area; the liquid fraction decants and flows by gravity into the Active Clearwell. From the Active Clearwell, the transport water is returned by pipeline (the return water line) to the phosphoric acid plant for reuse. The pipelines are moveable. There is usually one spare (gypsum) line.
- Pumps are used to deliver water from ditches and toe drains to clearwells and from one clearwell to another and to move water from the clearwells to either the permitted outfall or to the phosphoric acid process area.
- Trac hoes and other earth-moving equipment are used to maintain levees, to contour gypsum stacking areas and to manage soil (clay capping) for the purpose of growing grass on selected surfaces of the inactive and active stacking areas.

The facility is designed to store gypsum in large stacks. Decisions concerning stacking locations, areas and rate-of-rise have been made based on the recommendations of geotechnical consultants. The gypsum slurry is deposited in a prepared receiving area where there are small dikes constructed of gypsum to direct the discharged gypsum slurry into the right channels so that the gypsum settles out and the water decants into the Active Clearwell. Furthermore, trac hoes are utilized to construct additional channels within the stacking area and the excavated gypsum is used to increase the height of the levees.

IT RESPONSES

523.A. A discussion demonstrating that the potential and real adverse environmental effects of the facility have been avoided to the maximum extent possible;

<u>Response</u>

This application does not propose a new facility. Rather, this application is a permit renewal application for an existing, previously permitted solid waste gypsum stacking facility (facility) located within the boundary of the PCS facility in Geismar, Louisiana. The design of the facility meets all applicable state and federal regulations. The principal objectives of the facility design is to minimize the potential for adverse environmental effects and to avoid, to the maximum extent possible, any adverse environmental effects. Consideration has been given to location characteristics, facility characteristics, surface hydrology, storm water management, geology, and other factors in order to avoid and/or minimize to the greatest extent possible any adverse environmental effects. Additionally, the various mitigating measures incorporated into the design and physical configuration of the facility and the operational and institutional controls utilized at the facility demonstrate that the environmental impacts have been avoided to the maximum extent possible. The existing facility was permitted under the solid waste regulations in effect at the time of the issuance of the permit. Since that time, the requirements of Subtitle D of the Resource Conservation and Recovery Act (RCRA) have been incorporated into the Louisiana Solid Waste Regulations. The current regulations provide significantly greater environmental protections. Continued operation of the facility in accordance with these stricter standards assures that real and potential adverse environmental effects of the facility will be avoided to the maximum extent possible.

The facility is located in an industrial area. The facility is contained within property owned by PCS and was designed and constructed to minimize any potential pathways for the release of waste materials. All contaminated and uncontaminated storm water is directed through permitted outfalls and is sampled and reported in accordance with the terms of the facility's LPDES Permit. The facility is fenced on the north, west, and south. The east boundary is not accessible by automobile and warning signs are posted along the fenced areas. Gates are either locked or manned. In addition, plant security patrols are conducted during the day and night and plant operating personnel typically inspect the facility at least twice daily.

The facility is currently permitted to receive non-hazardous industrial solid wastes that consist of the following:

- Gypsum (also known as calcium sulfate dihydrate) generated as a result of phosphoric acid manufacturing;
- *Wastes from the manufacture of phosphoric acid* (contaminated filter cloths, rubber lining material, sludge, piping, scale, fire brick sandblasting waste, waste sulfur, ditch cleanout material, filter aid, cooling tower sludge, contaminated wooden pallets and plastic sheeting, and the like); and
- Soils and sludges contaminated with phosphoric acid and sulfuric acid, contaminated sulfuric acid media including filters, ceramic saddles, sludges, ditch cleanout material, metals (and the like).

Fire protection is not required or necessary for the facility because the waste does not pose a fire hazard. Nevertheless, fire protection is provided by a fire department, which is jointly managed by Honeywell, Williams, and PCS. The fire department is equipped with a fire truck, foam trailer and all associated equipment. Honeywell's fire truck is located in a central maintenance building just north of the PCS plant.

The potential adverse environmental effects from the facility include air contamination (including odor and dust), groundwater contamination, and surface water contamination. Other potential impacts include vectors and litter.

The following is a discussion of each potential adverse environmental impact:

Air Contamination, Litter, Vectors

There are no volatile organic compound air emissions from the facility that could endanger local residents or other living organisms. There is naturally occurring low level radiation in the gypsum and neglible hydrogen flouride air emissions.

The purpose of the grass cover is to reduce contamination of rainfall *runoff, to reduce infiltration, and to prepare the facility for ultimate closure.* The waste streams disposed of in the facility do not attract or harbor vectors, nor do they generate litter. Dust is not a problem because the gypsum is delivered as a slurry. The dried gypsum forms a hard cake on the surface ordinarily is not dusty and vehicular traffic is kept to a minimum.

Groundwater Contamination

Water Bearing Zones

The geologic setting encountered within the upper approximately 100 feet of the subsurface beneath the PCS surface impoundments/gypsum stacks is characterized by deposits of the Mississippi River Alluvial plain. These sediments are comprised predominately of low permeability silty clay and clay. However, several relatively more permeable silty to sandy zones are lenticular, of varying thickness, and laterally discontinuous in nature. Below a depth of approximately 50 feet, a thicker sand interval, probably representative of a river channel deposit or a point bar, is encountered. Three permeable zones are encountered within the upper approximate 50 feet of the subsurface beneath the impoundments/gypsum stacks. These zones are referred to as the "A-Silt", the "B-Silt, and the "C-Silt".

The "A-Silt" is the uppermost permeable zone encountered beneath the site. This zone is normally encountered approximately 6 to 10 feet below surface level (ft bls). The "A-Silt" is thin and discontinuous; therefore, it is not considered a viable water-bearing zone. The "B-Silt" is the second permeable zone encountered beneath the site. This zone is normally encountered approximately 15 to 20 ft bls and ranges from 4 to 6 feet thick. The "B-Silt" is thicker and more continuous than the overlying "A-Silt"; however, it is not present across the entire site. The "B-Silt" is regarded as the uppermost continuous water-bearing zone beneath the site. It is difficult to distinguish between the A-silt and the B-silt; therefore, it has been termed the A/B-silt zone. The "C-Silt" is the third permeable zone encountered beneath the site. This zone is normally encountered approximately 40 ft bls and ranges in thickness from 7 to 15 feet. The "C-Silt" appears to be continuous across the entire site. The "C-Silt" is considered the second water-bearing zone beneath the site. The "C-Silt" is immediately underlain by a dense sand zone (Shallow Aquifer), which may be representative of river channel deposits or a point bar.

Groundwater Flow Regime

According to the A/B-Silt zone Potentiometric Maps included in Appendix O, groundwater flows to the west, northwest, north, and northeast (somewhat radial). Therefore, existing piezometers/monitor wells P-4, P-5, P-7, P-8, P-9, P-11, P-13, P-20, P-22, and P-23, which are located around the perimeter of the area encompassing Stacks 1 through 7, will determine groundwater flow direction in the A/B-Silt zone. In addition, piezometers/monitor wells P-B1 through P-B22 will be installed around the perimeter of the gypsum stacks to supplement the existing well data in determining groundwater flow direction in the B-Silt zone. These wells will be screened in the A/B-Silt zone.

According to the C-Silt zone Potentiometric Maps also included in Appendix O, groundwater flows predominately to the northwest, but also flows to the north/northwest and to the east on occasions. Therefore, existing piezometers/monitor wells P-6, P-12, P-14, P-15, P-17, P-18, P-19, and P-21, which are located around the perimeter of the area encompassing Stacks 1 through 7, will determine groundwater flow direction in the C-Silt zone. In addition, piezometers/monitor wells P-C1 through P-C21 will be installed around the perimeter of the gypsum stacks to supplement the existing well data in determining groundwater flow direction in the C-Silt zone. These wells will be screened in the C-Silt zone.

The placement and construction of the existing wells and the proposed wells are designed to detect contamination emanating from the facility. The wells were placed as close to the stacks as practicable and screened in the stratum most likely to be affected by contaminant migration. PCS will operate and maintain these wells to perform to design specifications throughout the life of the monitoring program.

Groundwater Quality

Large quantities of groundwater of acceptable quality are not available at the site. Throughout Ascension Parish, groundwater is contained in alluvial and deltaic deposits of the Mississippi River, and moderate to large yields are obtained from wells tapping sandy and gravelly strata, commonly below depths of 100 to 150 feet. Surficial strata and those at shallow depth are predominately clays and silts, confining groundwater below. The area's principal water zone to the northeast of Geismar is the Gonzales Aquifer at depths of about 300-600 feet. It yields water that is generally fresh and softer, containing less iron than water from aquifers above. Toward the southwest, including the area of the Geismar Complex, brackish water occurs at progressively shallower depths. It is found at about 550 feet in the lower part of the Gonzales Aquifer near Geismar and at 200 feet or less in younger alluvium in an area south of the St. Gabriel oil field along the Iberville/Ascension Parish boundary (Long, 1965).

Overview

A naturally occurring liner consisting of at least three feet of natural clay with a coefficient of permeability no greater than 10^{-7} cm/sec underlies the site. The constructed liner system for Stack 8 will consist of 2 feet of recompacted clay (10^{-8} cm/sec) overlain with a 60-mil High Density Polyethylene (HDPE Liner).

The rationale for the design of the liner systems is based on the characteristics of gypsum stacks, as well as the existing clay. Besides sulfates, the main potential groundwater pollutants from a gypsum facility are orthophosphate and fluoride, both of which migrate through clay very slowly and with great difficulty. Clay is an excellent barrier for both species. In addition, the clay has a very low permeability to water.

There are three kinds of leachate collection activities: (1) collection of leachate in toe drains around the Inactive Clearwell; (2) collection of leachate that leaches from the lower sides and bases of the stacked gypsum in the perimeter ditches, internal ditches, and clearwells; and (3) under drains from areas lined with HDPE. The leachate removal system consists of the toe drains, ditches, clearwells, and pumps. Leachate that drains into a ditch of an active stacking area is sent to the Active Clearwell for use as process water. Additionally, an under drain with HDPE perforated pipe will be installed beneath Stack 8.

The decant ditches and the leachate collection systems are designed to prevent run-off of rainfall from the facility and to cut off lateral movement of seepage from the stacks. Decant ditches and leachate collection systems are standard within the industry.

Both stacking units are, and will continue to be, surrounded by groundwater monitoring wells and analytical results will be submitted to the LDEQ in periodic reports. The groundwater monitoring program in place is sufficient for detecting, reporting, and verifying changes in groundwater quality. In conjunction with the design and operational characteristics, favorable site characteristics minimize potential adverse impacts. If contamination of groundwater from the facility is detected and confirmed, PCS will comply with the corrective action requirements of LAC 33:VII.709.E.9.

A number of facility design characteristics and operational characteristics minimize the potential adverse effects to groundwater posed by the facility's operations. These include the liner and leachate collection systems and the groundwater monitoring system, as well as the careful control of incoming waste types. The quantity and characteristics of the gypsum slurry received at the facility is consistent and the gypsum travels via pipeline directly from the process to the gypsum facility. Overall, these measures prevent the spread of constituents to subsurface soils and groundwater and facilitate detection of any possible migration as soon as possible.

In addition, there are no known aquifer recharge areas within the facility or within 1,000 feet of the facility perimeter. Where there is no potential for aquifer recharge in the area of the solid waste unit, and the soil underlying the area inhibits the migration of leachate, locational characteristics act to significantly, if not completely, reduce any adverse impacts. Clearly, the site characteristics act to minimize, to the extent possible, threats to groundwater.

Surface Water Contamination

The main operating area of the facility is the area where gypsum slurry is deposited. This area, the active stacking area, is channeled and diked to direct decant water and rainfall water towards the Active Clearwell. Because of the elevation of these areas, surface drainage will not flow through the main operating areas of the site, but away from them.

Surface run-off from the facility is collected in interceptor ditches and pumped to the Inactive Clearwell. Surface drainage surrounding the facility cannot run onto the facility because the elevation of the interceptor (perimeter) levees has been set several feet higher than the adjacent land surface and as high as or several feet higher than the 100-year flood plain of 15 feet mean sea level (msl). The top elevation of the interceptor levee associated with the west unit is approximately 18.2 msl.

The east unit (Stack 8) is not yet operational. Preliminary work on the east unit has consisted of erecting a small berm approximately five feet above grade around the perimeter of the proposed stacking area. The proposed top elevation of the interceptor levees for Stack 8 is approximately 20.0 msl.

The stacking facility lies within the 100-year floodplain, and, in effect, on the southwestern corner of that floodplain. The southern boundary of the stacking facility lies on Louisiana Highway 30 and the western boundary lies on Louisiana Highway 3115, which restricts the flow independently of the facility. In general, the natural flow is to the north away from the Mississippi River so that the presence of the facility, which is located on the edge of the flood plain, has little effect on the flow of floodwaters within the flood plain and floodwaters have little effect on the facility.

Additionally, the facility is not located within one mile of a known fault and there are no known shot holes, seismic lines or private water wells within the facility or within 2,000 feet of the facility. Also, there is no public water system within one mile of the facility. Approximately 40% of the existing land use within three miles of the facility is agricultural, and 30% is industrial and manufacturing. As such, environmentally sensitive areas are avoided or protected by effective barriers.

523.B. A cost-benefit analysis demonstrating that the social and economic benefits of the facility outweigh the environmental-impact costs;

Response

Operation of the gypsum disposal facility is required for continued plant operations. The plant employs approximately 300 employees (including contract and maintenance employees). There are also economic benefits to the local vendors and suppliers that conduct business with the plant.

The plant produces a fertilizer material (phosphate) that is essential to modern agriculture.

The economic viability of the facility is dependent upon the ability of PCS to operate the on-site non-hazardous solid waste stacking facility. It would be economically burdensome to transport to an off-site facility the amount of gypsum the plant generates daily. The transport of the waste to an off-site facility around the clock would be a burden on the surrounding communities, as well as to the public roads. Additionally, due to current environmental regulations, the low level radioactivity associated with the gypsum precludes its disposal in conventional non-hazardous solid waste landfills.

The facility was originally permitted at the present location both because it is owned and operated by the company operating the phosphoric acid manufacturing plant it serves and because it is located adjacent to the phosphoric acid manufacturing plant it serves. The facility accepts only those waste streams specifically permitted to be disposed on-site and generated at the fertilizer plant. The vast majority of the permitted waste stream volume is transported to the stacking facility by pipeline. The facility is located in an industrial area where the majority (70%) of the total existing land use within three miles of the facility is agricultural, industrial and manufacturing. Economic development will not be precluded by this renewal application because the stacking facility is already established and the permit renewal application will not negatively impact the economic viability of the surrounding community. In actuality, the surrounding community, parish and state all benefit from the existence of the PCS plant. The plant employs nearly 300 full-time employees with a payroll in excess of $18,895,969 a year. This figure is increased when the economic multiplier is considered. In addition, PCS pays approximately $3,895,011 a year in combined parish and state taxes. Since the facility is an existing facility, property values will not be affected. Furthermore, the waste material is transported within the plant complex. Public roads are not used with the exception of crossing Highway 30 from the production site to the stacking facility.

In addition, the facility is owned and operated by PCS. The responsibility for the operation, closure, and post-closure maintenance and monitoring will remain with PCS. Financial assurances are provided on an annual basis to the LDEQ in accordance with the Solid Waste Regulations.

In order to identify environmentally sensitive areas that could be affected by the facility, investigations were conducted and correspondence was sent to several Louisiana offices requesting a file review for environmentally sensitive areas near the gypsum facility. The results are as follows:

- There are no known historic sites, recreation areas, designated wildlife-management areas, swamps or marshes, or habitats for endangered species within 1,000 feet of the facility perimeter;
- The facility is not located within one mile of a known fault;
- There are no known shot holes, seismic lines or private water wells within the facility or within 2,000 feet of the facility;
- There is no public water system within one mile of the facility; and
- There is no known aquifer recharge area within the facility or within 1,000 feet of the facility perimeter.

In summary, the viability of the plant is dependent on PCS's ability to renew the permit for the gypsum facility and to continue utilizing the on-site non-hazardous solid waste disposal facility. The gypsum facility is a key element in the continued operation of the plant and the long-range waste management plan for the plant. The need for the facility is influenced by many factors. The on-site method of disposal provides a cost effective mechansim for the management of gypsum generated by the phosphoric acid manufacturing process. By disposing of the non-hazardous waste on-site, PCS can operate the facility in an efficient manner while ensuring that the waste is disposed of in an environmentally sound and cost effective manner.

Additional consideration should be given to the fact that inherent in renewing a permit for an existing solid waste disposal facility are few in number when compared to the potential impacts inherent in permitting a new and separate facility in an area previously unaffected by waste management operations. Negative economic impacts that would ordinarily be associated with locating a new solid waste disposal facility are minimized in the context of this application. The likelihood of serious environmental harm is significantly decreased since the facility is subject to stringent solid waste regulations. The fact that the current application involves the renewal of a permit for an existing facility located within the boundaries of a plant must not be overlooked in balancing the costs and benefits associated with the operation of the facility. Finally, there is a need for the gypsum facility since it is an indispensable part of the day-to-day operations of the PCS plant. An assessment of the benefits and the need for the continued operation of the existing facility, show clearly that the social and economic benefits of the facility outweigh the environmental-impact costs.

523.C. A discussion and description of possible alternative projects which would offer more protection to the environment without unduly curtailing nonenvironmental benefits;

<u>Response</u>

Because of the chemistry of the wet process for manufacturing phosphoric acid, phosphoric acid cannot be produced without also producing phosphogypsum. Gypsum management options include (1) use as a raw material in other processes, (2) use as is, (3) storage pending development of beneficial uses, and (4) permanent disposal. Current environmental regulations prohibit land application of the gypsum due to low level radiation. The facility plans to store gypsum pending development of beneficial uses. If beneficial uses are not eventually developed, the facility would then serve as a permanent storage disposal site for the gypsum.

In theory, gypsum can be utilized as a raw material for the recovery of, among other things, sulfur dioxide and aggregate materials. The process is energy intensive and requires favorable site-specific interdependent factors for success. The technology is not yet proven and all adverse environmental problems have not yet been identified. Importantly, it is not yet commercially feasible.

Should methods be developed to remove the low level radiation or current environmental regulations change allowing the beneficial use, there are several current uses for phosphogypsum. The principal uses are as a source of calcium and sulfur for agricultural soil and as a soil amendment and conditioner, mainly on sodic soils. However, demand is insufficient to consume a significant fraction of the phosphogypsum currently generated by the facility. In addition, the distance to potential markets, competition, and as well as impediments created by regulatory programs regarding the low level radioactivity preclude the possibility of the use of even small amounts of phosphogypsum in the near future.

Currently, the gypsum is managed in accordance with an updated gypsum - stacking plan. Formerly, it was the practice at the facility to design a gypsum stacking area in the form of a single stack and when it reached a certain height, the stack was inactivated and a new stack was constructed.

The current gypsum stacking plan accomplishes two principal objectives: (1) to delay for as long as possible the need to construct a new stacking facility by converting the existing stacking area into one common stack, and (2) to improve the quality of water discharged to the surface waters of the state (the Mississippi River). The current stacking plan makes better use of the existing gypsum stacking areas and will accommodate the gypsum produced at the plant until approximately 2015. As such, the useful life of the existing facility is extended and the construction of Stack 8 is deferred.

Converting to a common stack has increased (or will increase) storage capacity by: (1) utilizing areas between stacks, (2) utilizing areas that currently are clearwells, and (3) stacking the gypsum to greater heights through the use of HDPE liner technology. The modified stacking plan has resulted in delaying construction of Stack 8 and minimizing rainfall collection areas.

The method for depositing gypsum has and will remain unchanged. The only change is where the gypsum will be directed. As stated above, the Active and Inactive Clearwells ultimately will be relocated. The usual stack instrumentation such as inclinometers, piezometers, and observation wells will be installed as required.

The gypsum - stacking plan will be implemented over the life of the facility. The plan includes several elements that are not essential to the storage of gypsum but nevertheless are necessary to operate the facility in an environmentally sound manner:

- Installation of a soil/grass cover on inactive and active portions of the facility;
- Construction and operation, if necessary, of evaporation ponds on inactive portions of the stacks; and
- Segregation of waters of differing quality. Decant water from the gypsum slurry and leachate from inactive and active stacks (decant and leachate are the two most contaminated types of waters) are collected and routed back to the process. The management of active and inactive water are governed by the terms of the LPDES discharge permit.
- This facility was built to service the PCS plant. As such, it is the most environmentally sound approach to the management of gypsum generated at the PCS plant. PCS has developed a long-term waste management strategy that consists of volume reduction, research and development to identify and implement viable waste minimization techniques~~,~~ and beneficial re-use alternatives.

There are no commercial facilities in the area that meet the requirements for accessibility, capacity and/or technical adequacy to meet the specific disposal needs of PCS. More important, PCS is capable of constructing and managing a disposal facility in a manner that is considerably more protective of the environment and secure than an off-site commercial facility. This is due in large part to the quality control procedures in place at the PCS plant that ensure that only non-hazardous waste is disposed in the gypsum facility. As such, environmental impacts are minimized. Moreover, the site is inspected routinely and the monitoring wells are sampled in accordance with existing regulatory requirements.

PCS has designed the remaining phases of the gypsum stacks to optimize airspace. This design extends the life of the facility without increasing the facility footprint, thereby reducing the environmental impacts associated with any further expansion of the facility.

523.D. A discussion of possible alternative facilities which would offer more protection to the environment without unduly curtailing nonenvironmental benefits; and

Response

PCS is applying for a renewal of a permit for an existing facility. Because this is an existing facility, a traditional site analysis is not appropriate and therefore was not conducted. PCS manages an existing site with an existing infrastructure and operational procedures. In light of the fact that it is an existing facility for the disposal or long term storage of gypsum generated on-site and constructed and operated using state-of-the-art technology, there are no other sites that could provide more protection. The existing facility is in a heavily industrialized area. As such, the surrounding areas will not be adversely impacted by the renewal of this permit.

Furthermore, there are no alternative facilities that would offer more protection to the environment than the existing facility. Every such facility would have to be based on the land management of gypsum. If such a facility were identified, it would have to be reached by pipeline, truck, train, or barge. Transportation studies have shown that any such transport of gypsum would not be feasible because of cost. In addition, when one considers the increased environmental threat such transportation activities would pose, the site chosen would not differ significantly from the existing facility in terms of environmental management considerations. Finally, a remote site would reduce plant control and introduce additional management difficulties.

The facility is not located within one mile of a known fault and there are no known shot holes, seismic lines or private water wells within the facility or within 2,000 feet of the facility. There is no public water system within one mile of the facility. Additionally, there are no known historic sites, recreation areas, designated wildlife-management areas, swamps or marshes, or habitats for endangered species within 1,000 feet of the facility perimeter. Approximately 40% of the existing land use within three miles of the facility is agricultural and 30% is industrial.

The perimeter levee system is sufficient to prevent the run-on and run-off of storm water from a 24-hour, 25-year storm event and is sufficient for the storm surge predicted during a hurricane event. The levees are well maintained by operations personnel to prevent erosion. The facility is constructed with a naturally occurring liner and a leachate collection system. In addition, an upgraded groundwater monitoring system that meets the current regulations is proposed in the renewal application.

Waste stored in the facility does not emit any organic vapors, gases, or odors; nor is it putrescible. While gypsum emits low level radiation and there are neglible hyrdogen fluoride emissions, the levels are such that the facility will not adversely impact the air. Moreover, the current solid waste regulations hold the entire renewal process to a higher standard. As a result, the design, construction, operation, and groundwater monitoring system of the facility will be very protective of human health and the environment.

Siting and developing a company owned and operated disposal facility is more advantageous than a commercial facility because of the operations at the existing plant and the quantities of gypsum produced. Specifically, the logistics and costs of moving large quantities of gypsum on both local and interstate roads 24 hours/day is prohibitive. Similarly, the barging of this volume of material long distances presents risks that are avoided with a company-owned/operated facility. A commercial facility would have to be capable of managing and disposing the large quantities of gypsum generated each day. Even more important, it would essential to the continued operation of the PCS facility that the commercial facility have the ability to manage and dispose of the gypsum 24 hours/day. Typically, commercial facilities do not operate 24 hours/day. By managing the gypsum on-site, there is a significant reduction in the risk of highway accidents as the gypsum is directly piped to the gypsum stacks. Commercial facilities cannot offer the level of short-term and long-term environmental management and operational control that PCS provides with its own design, construction and operation. PCS has long-term goals of identifying alternative management options for gypsum, as well as minimizing the waste disposal footprint at the existing facility. The decision to develop an on-site waste management facility is based on economic feasibility and technological soundness. The site was selected because it was owned by the facility and because of its close proximity to the plant where the gypsum is generated. The facility only receives waste generated internally at the PCS site. Utilizing available on-site property is conducive to proper long-term management of the facility's waste stream.

The facility does occasionally experience hurricane force winds and rain. PCS maintains emergency procedures that address preparation for and operation of the facility during threats of hurricanes. The primary threat for the facility associated with hurricanes is the quantity of rainfall that may be received. The facility is designed for a 25-year/24-hour storm water event; the PCS management systems allow for maximum freeboard within the storm water ditches and ponds to control the potential additional runoff associated with such an event.

There are no alternative sites that would offer more protection to the environment than the proposed facility without unduly curtailing non-environmental benefits.

523.E. A discussion and description of the mitigating measures which would offer more protection to the environment than the facility, as proposed, without unduly curtailing nonenvironmental benefits.

<u>Response</u>

The existing west unit will be used to accommodate the maximum amount of gypsum per unit area that is possible and both units of the facility will be covered with a soil/grass cover. As a result, at the time closure activities begin on the stacking areas all but approximately 10 acres will be under cover. In addition, both units are surrounded by containment levees that will prevent surface run-on and run-off.

The design of the gypsum facility complies with all state and federal regulations governing solid waste disposal. There are no additional mitigating factors that have been identified that would offer more protection to the environment than the facility as proposed without unduly curtailing nonenvironmental benefits. The protective measures in place include:

- A perimeter levee system to prevent migration of gypsum and water from the facility;
- A recompacted clay liner with a permeability of 10^{-8} cm/sec overlain with a 60-mil HDPE liner for Stack 8;
- A leachate collection system; and
- A groundwater monitoring system designed to detect any release of constituents from the facility before any such contamination can move either off-site or into surrounding groundwater aquifers.

The gypsum facility is designed as an integral part of the waste management plan of the PCS plant. The gypsum facility provides a temporary storage or permanent storage (end-point disposal) destination for gypsum generated by the plant. The facility only serves the PCS plant. The dedicated nature of the solid waste unit ensures that no off-spec wastes will be placed in the unit. Moreover, waste minimization, recovery, and recycling are all part of the facility's overall waste management plan.

The on-site disposal of this material is beneficial because the waste never leaves the PCS facility. The facility is constructed and operated in an environmentally sound manner and the integrity of the system is maintained and monitored by a groundwater monitoring system. The only waste disposed in the stacks is generated at the PCS plant. Any waste not permitted to go into the stacks is sent off-site for proper disposal. The handling, transporting, and disposal of all of the waste disposed in the facility is under the direct supervision of PCS personnel.

The northeast corner of Stack 6 in the west unit and the north boundary of Stack 8 in the east unit of the facility lie within 1,000 feet of a wetlands area. However, the west unit is designed with levees as high as or several feet higher than the flood plain and several feet higher than adjacent land so there is no runoff from or run-on to the facility and the levees are inspected at least twice daily. In addition, the east unit will be constructed with levees adequate to protect surrounding areas.

The facility lies within the 100-year floodplain but the presence of the facility has little effect on the flow of floodwaters within the flood plain and floodwaters have little effect on the facility. Furthermore, surface run-on is prevented because the elevation of the interceptor (perimeter) levees have been set several feet higher than the adjacent land surface and as high as or several feet higher than the 100-year flood plain.

As such, there are no other mitigating measures that would offer more protection to the environment without unduly curtailing non-environmental benefits.

TABLE 1

SUMMARY OF INVESTIGATIONS

TABLE 1

SUMMARY OF INVESTIGATIONS

REPORT NO.	DESCRIPTION
A	EVALUATION OF GYPSUM STACK STABILITY GYPSUM PONDS 1 AND 2. (LAW, 1973)
B	EVALUATION OF GYPSUM STACK STABILITY, PONDS 1 AND 2. (LAW, 1977)
C	REPORT OF FIELD AND LABORATORY TEST. PROPOSED NEW GYPSUM STACK. (LAW, 1979)
D	INVESTIGATION FOR GYPSUM STACK PERMITTING REQUIREMENTS, PONDS 1, 2, 3, 5A, 5B, 7A & 7B. (LAW, 1979)
E	GEOTECHNICAL ENGINEERING REVIEW, GYPSUM STACK MANAGEMENT, STACK 2. (CAPOZZOLI, 1980)
F	GEOTECHINCIAL ENGINEERING, GYPSUM STACK EXPANSION, PONDS 3 AND 4. (CAPOZZOLI, 1980)
G	CLEARWELL ANALYSIS. (CAPOZZOLI, 1980)
H	GEOTECHINCIAL ENGINEERING, TEMPORARY GYPSUM STACK ABANDONMENT, STACK 4. (CAPOZZOLI, 1981)
I	GYPSUM STACK MANAGEMENT. (CAPOZZOLI, 1981)
J	INITIAL GEOTECHNICAL EXPOLORATION, LAND NORTH AND EAST OF PHOSPHATE GYPSUM PONDS. (CAPOZZOLI, 1983)
K	GEOTECHNICAL INVESTIGATION, PONDS 5 AND 6. (CAPOZZOLI, 1985)
L	GEOTECHNICAL ENVESTIGATION, PONDS 1 AND 2. (EUSTIS, 1987)
M	GEOTECHNICAL INVESTIGATION, CONVERSION TO COMMON GYPSUM PONDS. (EUSTIS, 1994)
N	MONITORING STACK INSTRUMENTATION, CONVERSION TO COMMON GYPSUM STACK. (EUSTIS, 1998)
O	GEOTECHNCIAL INVESTIGATION, GYPSUM STACK NO.7 (EUSTIS, 1988) INCLUDES 9 BORINGS PERFORMED BY L.J. CAPOZZOLI & ASSOCIATES (1987).
P	GEOTECHNICAL INVESTIGATION, GYPSUM STACK NO. 8 (EUSTIS 1992)